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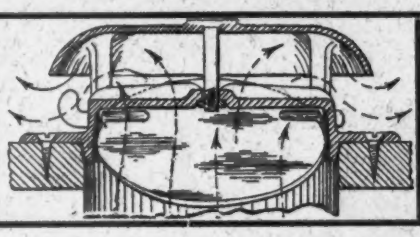

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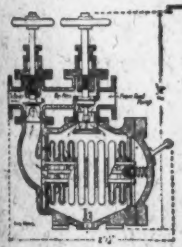

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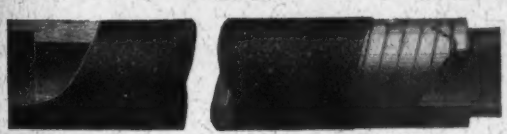

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK SEPTEMBER, 1911

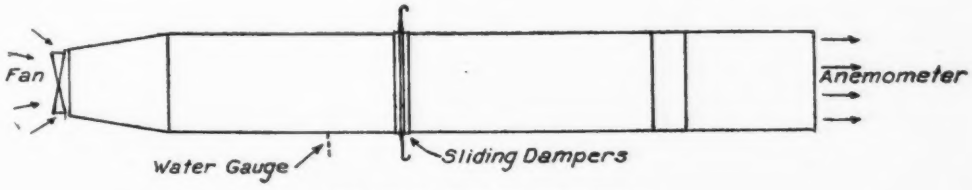
Characteristics of the Propeller Fan

The behavior of the propeller type of fan under varying conditions of speed and resistance was the subject of some noteworthy tests made by Oswald Stott, of Birmingham, England, which were reported in detail by him at the recent meeting of the Institution (British) of Heating and Ventilating Engineers. The tests were undertaken to determine primarily the amount of power utilized under these varying conditions, but the output was also noted.

The tests were all taken on the discharge side of the fan. Mr. Stott first made theoretical deductions as to the results likely to be observed at the discharge side, the intake or feed side of the fan being taken as unrestricted in any way.

The blades of a propeller fan, it was noted, are of the nature of a screw so that the traverse is doubled if the revolutions are doubled. As they are stationary, taken parallel with the shaft, the air is moved with a velocity depending upon the pitch of the blades and the efficiency of the design. Thus the velocity of the air moved by the blades should, apparently, be proportionate to the revolutions, and, therefore, to the volume. As to the power consumed, this may be proportionate to the revolutions or to some function of them, yet there may be no definite ratio. Using a well-known formula to ascertain the kinetic energy in the air moved, Mr. Stott showed that, theoretically, the power varies as the cube of the revolutions.

To present a clearer idea of the probable action of a propeller fan working against a resistance, Mr. Stott took as an analogy the ordinary parallel vise. The screw represents the fan, the movable jaw the air. When the jaws are open, we impart motion to it by turning the screw. The speed of the jaw depends upon the speed of rotation of the screw, so that the pressure produced at the screw appears as velocity of the jaw. When the jaw reaches the fixed partner, its forward movement is arrested and pressure reappears. The degree of pressure depends upon the force



ARRANGEMENT OF TEST DUCT

applied to the handle and may be sufficient to break the weakest part of the vise.

Taking any part of a fan blade, except the tips, it seems probable that the maximum pressure which that part is capable of maintaining will be the equivalent of the velocity of air, with free discharge, produced at that point. It may be

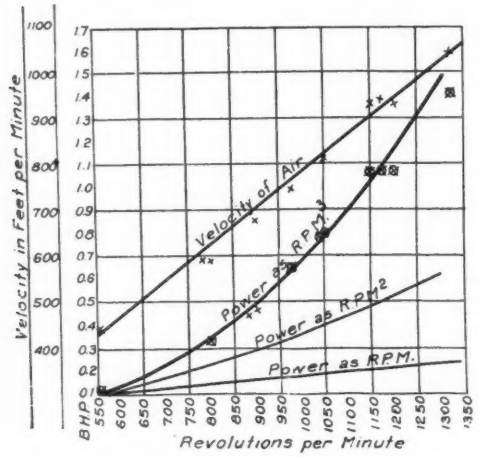


FIG. 1. RESULTS OF TEST WITH FREE DISCHARGE

less, but it is difficult to imagine it being more because, air being a liquid, there will be a release at that part immediately the pressure tends to rise beyond that maximum. This constitutes the "slip" which, as is well known, always occurs when a propeller fan is working against a resistance. As

$$H = \frac{V^2}{2g}$$

apparently the static pressure (measure of resistance) will be proportionate to the square of the revolutions because the slip should be similarly proportionate. Mr. Stott noted that this theoretical characteristic, if correct, is less likely to be borne out by experiment owing to eddy currents in the fan.

The element of "slip," as Mr. Stott stated, is one of the principal points of difference in the operation of a propeller fan and a centrifugal fan, as the latter requires maximum power at free discharge.

Proceeding to a discussion of the results actually obtained by test, Mr. Stott stated that he used a propeller fan 24 in. in diameter over the tips, belt-driven by an electric motor. The fan was fixed upon a frame and discharged the air through a horizontal duct 36 in. x 36 in. x 25 ft. long. At a distance of 11 ft. from the fan, sliding dampers were inserted when required, to create a resistance to the passage of the air. By means of these dampers any desired resistance up to the maximum could be obtained. Shutting the dampers completely together completely blocked the outlet from the fan, except for a very slight leakage, thus preventing the passage of air almost entirely.

An anemometer was placed in the end of the duct opposite that occupied by the fan. As the area of this end of the duct was constant the air velocities only were obtained for comparison. To measure the created resistance a water gauge was used connected by a tube to the duct at a point about 2 ft. on the fan side of the dampers. A speed counter was used to measure the revolutions of the fan and 1-min. readings were taken.

As the primary object of the

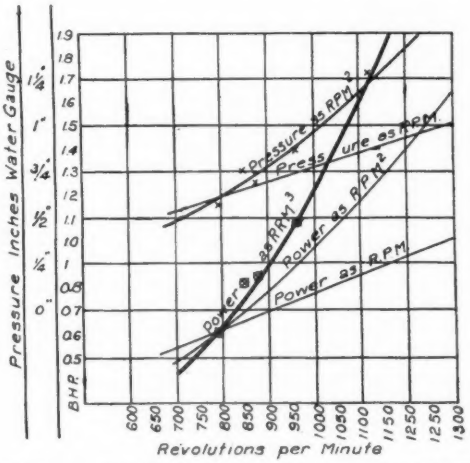


FIG. 2. RESULTS OF TEST WITH OUTLET ENTIRELY CLOSED

tests was to decide, if possible, the ratio of the power to the speed, considerable care was taken to have an accurately calibrated motor. One of 2 B. H. P. was used.

TESTS WITH FREE DISCHARGE

The first series of tests was taken with free discharge, the dampers being entirely removed. These tests showed that the air moved is proportionate to the revolutions of the fan. They also show conclusively that the power taken is proportionate to the cube of the revolutions. In the accompanying charts three power curves are given, the first being proportionate to the revolutions, the second to the square of the revolutions, and the third to the cube of the revolutions. The recorded tests follow the latter. Mr. Stott's paper contains detailed figures from which the charts were plotted.

The next series of tests was taken with the dampers fully closed and remaining in the same discharge and giving the maximum resistance. The resistance was measured as pressure and is given by the water gauge set up. It is found to be proportionate to the square of the revolutions. The

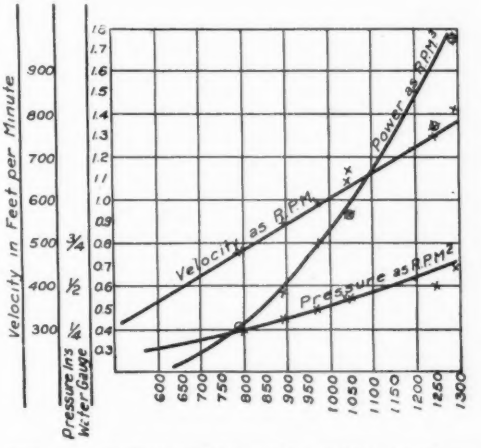


FIG. 3. RESULTS OF TEST WITH OUTLET PARTIALLY CLOSED

tests show that the power is proportionate to the cube of the revolutions.

The next series of tests was made with the dampers partially closed and remaining in the same position for every test, thus maintaining a constant "condition of resistance" for all speeds. Under these conditions the velocity of the air was found to be proportionate to the revolutions. The resistance was proportionate to the square of the revolutions and the power was proportionate to the cube of the revolutions.

Another series of tests, taken with the dampers more open, thus

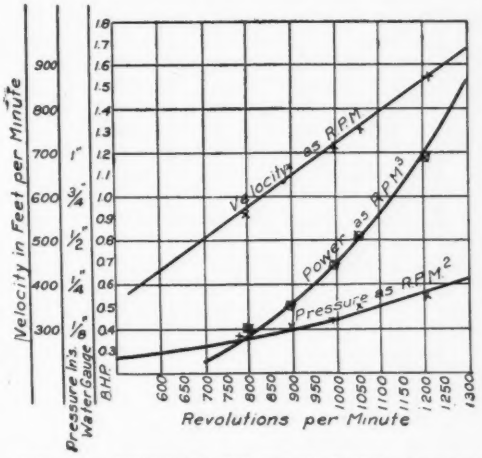


FIG. 4. RESULTS OF TEST WITH OUTLET PARTIALLY CLOSED

setting up less resistance, showed the same characteristics as the last record.

A fifth series of tests was taken as near a constant speed as possible, but with varying resistance obtained by moving the dampers nearer together for each succeeding test until fully closed. These tests showed clearly that the power rises to a considerable extent as the resistance is increased, following closely the theory of the characteristics of the propeller fan, as already outlined.

Commenting on the tests Mr. Stott points out that the manufacturers' statement that the power varies as the square of the speed does not take into account the difficiencies in efficiency of the motor, which are considerable. In the tests in question, for instance, the efficiencies varied from 25% to 75%. "I fancy," added Mr. Stott, "this is the rock upon which these makers may have been wrecked."

In one respect the tests do not support the theory that "the maximum pressure which that part is

capable of maintaining will be the equivalent of the velocity of air (with free discharge produced at that point." The tests show that the maximum pressure set up, at a given speed, is greater than the equivalent of the greatest velocity

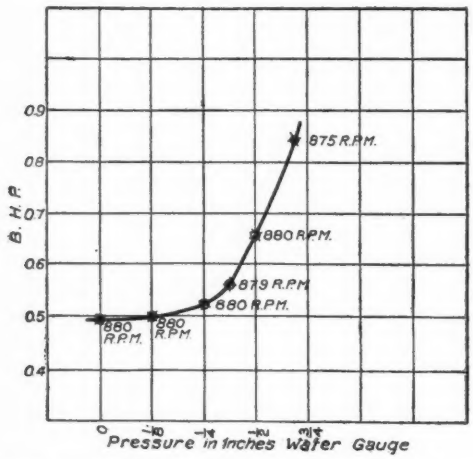


FIG. 5. RESULTS OF TEST WITH CONSTANT SPEED AND INCREASING RESISTANCE

of air at any point. Upon looking into this, Mr. Stott found that the velocities measured at different points of the fan from center to circumference are less than the forward traverse of the blade at that point. He also found that, with the particular fan tested, the maximum resistance registered (pressure set up), with the closed outlet, for a given speed, was the equivalent of the forward traverse of a part of the blade about 8¾ in. from the center, say on a circle 17½ in. diameter. It would take a special apparatus to decide this point, but it appears probable that, taking any given speed, the maximum pressures capable of being set up by various points of the blade from center to circumference will be the equivalents of the forward traverse of the blade at those points, and not the equivalent of the velocity of air measured at free discharge.

Another point noted by Mr. Stott is that when working against resistance there is, for a given speed, a point at which the mechanical efficiency is highest, just where, however, he was unable to say. It was not, as he had anticipated, at low resistance for the particular speed in question, but at a higher resistance.

Progress of Street Car Ventilation

Comments on present methods of street car ventilation, showing the growing interest in this subject, were made in a paper by W. Thorn, read at the recent summer meeting of the American Society of Heating and Ventilating Engineers, in Chicago. At the outset of his paper Mr. Thorn stated that the lack of attention given to this subject by street railway companies is not due to unwillingness on their part to provide proper ventilation for their cars, but is the result of a lack of thorough information and of ability to find practical apparatus or equipment for the purpose other than the usual means.

The problem of providing adequate ventilation in a street car, Mr. Thorn states, is not one easy of solution. The difficulties arise from several causes, among which may be mentioned the comparatively small capacity of a car body in which many people are carried, also the various desires and whims of passengers as to proper ventilation and the necessity for preventing drafts and chilling the air below the temperature required by the authorities.

The need for better ventilation than that afforded by the monitor or deck windows is much greater with modern pay-as-you-enter cars than with the double-end type of cars, which have both platforms open on one side to the air. This results from the fact that the front platform on the pay-as-you-enter cars is closed while on the other

cars it is open; therefore, the air cannot circulate so freely through the pay-as-you-enter car as through the double-entrance type when stops are made and the doors are opened to take on or discharge passengers.

To meet the need for better car ventilation several devices have been developed and are now on the market. The designers of some of these devices recognize that heating and ventilation should go together and have worked out their apparatus with this end in view. These ventilating devices or systems consist of two general types: first, those which depend upon the speed of the car for their operation. All such devices work on the aspirator principle. Second, are those systems which use mechanical means for circulation of the air and are practically independent of the speed of the car. Mechanical systems of both the exhauster and blower principle have been brought out.

Authorities differ as to the amount of air to be supplied per person per hour in order to provide adequate ventilation. An ordinance of the city of Chicago requires that in the ventilation of street cars not less than 350 cu. ft. of air per hour per passenger (based on maximum seated and standing load) shall be supplied; provided, however, that the carbon dioxide shall not exceed 10 parts in 10,000 parts of the air in the car. The 350 cu. ft. of air per hour per passenger shall be brought in through the openings or intakes provided for the purpose. There will also come into the car through cracks, crevices and the opening of doors a considerable volume of air. The ordinance further provides that the air for ventilation shall be brought into the car below the average level of the heads of the seated passengers and be taken out above the heads of the standing passengers, and that the intakes be so constructed as to exclude dust. It also provides that there shall be maintained within a car an average temperature not lower than 50° F.

There have been several ventilating systems tried out in Chicago, both the mechanical and automatic type, which are designed on the basis of the above outlined ordinance. Several hundred cars have been equipped with such ventilating systems.

(The author here gives a brief description of the Cooke car ventilating system, which was described at length, with illustrations, in THE HEATING AND VENTILATING MAGAZINE for April, 1910.)

The automatic systems installed are of several different kinds, but all depend upon aspirator action for their operation. One of these automatic systems, which has shown good results, comprises a number of "exhausters" located along each side of the monitor roof and attached to panels placed in the monitor or deck window openings. An opening in the panel communicates with the "exhauster." Intakes similar to those described in connection with the mechanical system are located in the floor and provide for a supply of fresh air. The "exhausters" are rectangular sheet metal boxes projecting outwardly from the panels to which they are secured, having openings top and bottom, and provided on the middle of each side face with V-shaped projections. The V projections are placed horizontally on the faces of the exhausters and "split" the air into two streams, one flowing upward and the other downward. The air streams flow past the openings of the exhauster and by induction "draw" the air out from the car.

The impression has generally prevailed that thorough ventilation could not be effected without increasing the amount of energy used for the heating of the car. Experience with the deck window method of ventilation in which the heating and ventilating systems are not closely related is undoubtedly responsible for this impression. Tests conducted on street cars with ven-

tilating systems, such as have been described, where the air in coming into the car passes first over the heating units and then is drawn up through the car and taken out at the top, demonstrate, however, that it is entirely possible to heat a car to substantially the same temperature with this system as when the deck window method is used, and with no greater expenditure of energy. We believe the reason for this lies in the greater efficiency of the heating units when working upon a continuous flow of fresh air passing over the heating surface as against the ordinary practice of placing the heating units in practically a dead air space where a considerable amount of the heating energy is lost in raising the temperature of surrounding parts of the car, such as the seats and the adjacent woodwork.

Tests made on both the mechanical and the so-called automatic systems show that it is possible to provide an air change in the cars about every three minutes, and this without the presence of objectionable drafts or the need of any more than the usual amount of energy for heating purposes.

In the light of experience with ventilating systems of the kind described, it can hardly be said that it is impossible to find practical means for the ventilation of a street car which will answer every reasonable requirement.

Features of the Reck Mixing System for Hot Water Heating

SAVING EFFECTED IN APPLYING THIS SYSTEM WHERE PUMPS ARE ELECTRICALLY DRIVEN

Many interesting points regarding the flow of hot water in pipes are brought out in a description of the Reck "Mixing" system, which was described at length by Capt. A. B. Reck, of Copenhagen, Denmark, at a recent meeting of the Institution (British) of Heating and Ventilating Engineers. The purpose of Capt. Reck's paper was to show the saving that could be effected by applying this system to hot water heating apparatus worked by electrically driven pumps. Capt. Reck presented four sketches (Figs. 1-4) giving an idea of the difference in the operation of a heating apparatus with and without the mixing system. In all the figures the horizontal pipe T represents the main flow pipe and the pipe U the main return pipe. The connections BF and BR between the mains and the risers are shown in Figs. 1 and 2 as ordinarily erected.

With these connections the cooled water which passes from the radiators and flows through the return risers LR finds no other passage further on than through the return main U that carries it to the boiler, from whence it returns to the radiators after having been reheated to the desired degree. Consequently, the temperature of the water as it enters the radiators will always be the same as the temperature in the boiler and in the flow main T, and if it is desired to diminish from a central point the temperature of the radiators by diminishing the temperature of the water in the flow risers, this can only be done by also diminishing the temperature of the water in the flow main T, as indicated in Fig. 2.

The Reck "Mixing" system consists in supplementing the ordinary pipe connections BF and BR by pipes through which, as may be desired, more or less of the water that has been cooled in the radiators can pass over and mix with the heated water that comes from the boiler through the pipes T and

BF. The pipes through which the water passes over are called the "mixing pipes," and will be found marked by the letter X in all the sketches (Figs. 1 and 2 excepted).

The action of these mixing pipes will easily be understood from Figs. 3 and 4, both of which show the same apparatus, only with the difference that in Fig. 3 the water must be imagined to have a greater velocity in the pipes T, U, BF and BR than in Fig. 4. If the motion of the water through the mains is caused by a pump, the velocity in the pumps may be varied by either

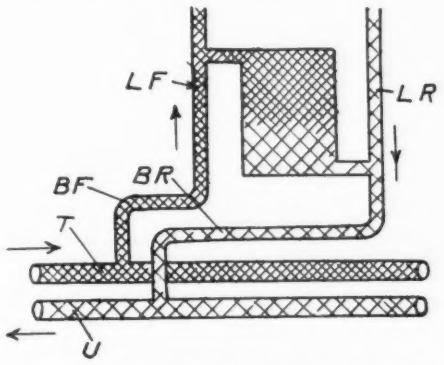


FIG. 1. ORDINARY HOT WATER HEATING SYSTEM, SHOWING MAXIMUM YIELD AT RADIATOR

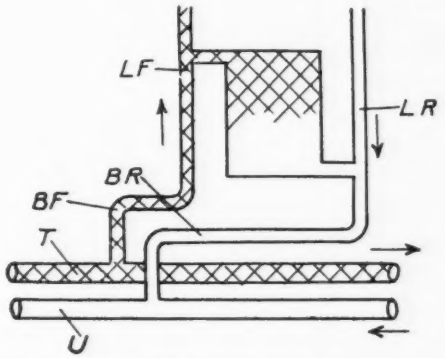
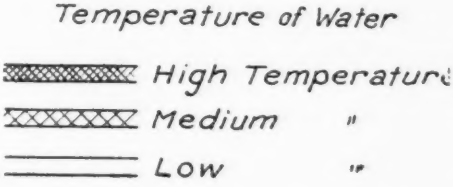


FIG. 2. ORDINARY HOT WATER HEATING SYSTEM, SHOWING MINIMUM YIELD AT RADIATOR

altering the speed of the pump or simply by more or less throttling a valve V on one of the mains, as shown in Fig. 4.

It will be seen that the mixing pipe X forms the link which completes the local circuit formed by the local flow riser LF, the radiators with their connecting pipes and the local return riser LR.

Suppose now that all the pipes in this local circuit are of such sizes that a quantity of water of the same temperature as the water in the horizontal flow main, and sufficient to heat the radiators to the desired degree, will pass through the pipes LF and LR only by the influence of the difference in temperature between the water in these pipes. Suppose, further, that the sizes of the branch pipes BF and BR, which connect the horizontal mains with the risers, are of such sizes that the same quantity of water, or, if not exactly so, then a little more, will pass through BF to LF when the pump that forces the water through the mains runs at its greatest speed and produces the greatest difference in pressure between the flow main T and the return main U, then Fig. 3 shows what will happen. All the water that has been cooled in the radiators will pass from the return riser LR through the branch pipe BR into the return main U. If the sizes of the branch pipes BF and BR happen



to be taken exactly, the water in the pipe X will remain quite still, and only if the sizes of these pipes have been taken a little too large will a small quantity of hot water pass over from the pipe BF to the pipe BR through the pipe X. This, Capt. Reck stated, does no harm at all. In both cases the movement of the water through the risers LF and LR and through the radiators will be the same as in an apparatus according to Fig. 1, where the pipe X does not exist.

It is only when the speed of the pump is diminished, or when the valve V on the main is throttled

down that the action of the pipe X begins. In both cases, the supply of water to the riser LF from the pipe BF will at once become smaller than the quantity the riser is able to take, and what additional quantity it can take will come from the return riser LR through the mixing pipe X. Since the temperature of the water in the return riser is lower than the temperature of the water in the pipes BF and T, the result will be that the temperature of the water in the flow riser LF will be reduced more or less below the temperature in the flow main T.

How much the temperature is reduced in this manner depends only upon how much the speed of the pump is diminished, or how much the valve V is throttled down, and thus it will be seen that the Reck mixing pipes afford means for regulating from a central point of a hot water heating apparatus the temperature of the water that flows to the radiators through the flow risers by diminishing the quantity, but not the temperature, of the water that is forced out through the flow mains. Further, it will be seen that the peculiar feature of an apparatus with Reck mixing pipes inserted is that the difference in pressures created by the pump does not reach those parts of the apparatus which are beyond the mixing pipes. By the ordinary system, without mixing pipes, this is not so, and, therefore, not only the sizes of the mains but also the sizes of the risers and radiator-connections must be calculated from the difference in pressure created by the pump. But, if in an ordinary apparatus the speed of the pump is diminished, the difference in pressure it creates will be diminished also, and the result will be that the velocity of the water to the radiators on the lower floors of the building will be diminished much more than the velocity to the radiators on the upper floors, where the additional difference in pressure created by difference in temperature in the long risers is much greater than on the lower flowers.

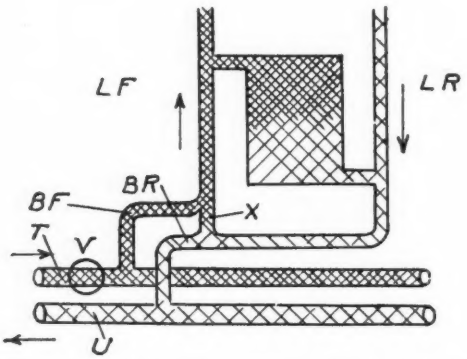


FIG. 3. ARRANGEMENT OF RECK MIXING SYSTEM, WITH VALVE V FULL OPEN, GIVING MAXIMUM YIELD

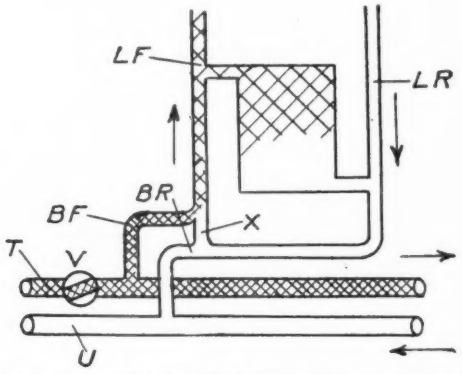


FIG. 4. ARRANGEMENT OF RECK MIXING SYSTEM, WITH VALVE V ONLY PARTLY OPEN, GIVING MINIMUM YIELD

Therefore, with the ordinary system, the only way to secure good distribution of heat between the different floors in a building is to let the speed of the pump be the same in mild weather and by night as in cold weather by day, whereas with the Reck "mixing" system at least nine-tenths of the time the pump has to run, its speed, as well as the power used, can be very much reduced.

Capt. Reck then presented an example, with illustrations, to prove these points, showing, from the results obtained that not only will the consumption of electric current be reduced, but a considerable saving will be effected in the first cost

of the heating apparatus, because the electric motor and the pump, as well as the sizes of all the mains, can be reduced to what is necessary for half the quantities of water. His paper also included illustrations of heating installations where several buildings, each with a number of radiators, are heated from a central plant. The illustrations included details of the piping.

In closing, Capt. Reck stated that in a school in Denmark, built four years ago, the valves on the radiators have never been touched by the occupants of the building. The handles of these valves were taken off and put in storage when the installation was completed and nobody has asked for the handles up to the present time.

Use of Steam Turbines in Heating Work

A paper presented at the recent summer meeting of the heating engineers, describing a central heating plant for two school buildings, presented by Samuel R. Lewis and published in THE HEATING AND VENTILATING MAGAZINE for August, mentioned the use of steam turbines in the power house, which, with other features, aroused an extended discussion, which was in part as follows:

PRESIDENT BOLTON: Here we have a description of an old plant which appears to bear the earmarks of success, so successfully remodeled that the new plant can be described in practically the same words as were used to describe the old remodeled plant.

I observe that the author has installed steam turbines in the school power house. I do not know why a turbine is desirable for such service, even with the explanation afforded by the author. The small steam turbo-generator is at present far from being a satisfactorily reliable apparatus. The speed at which it runs and the delicacy of the appliance require great care in its operation. In an office building in New York three steam turbo-generators have, on more than one occasion, become stalled when one machine would reverse another, driving it against steam with disastrous results.

The high speed at which turbines run produces, with a relatively small reduction in speed, a considerable drop in voltage. Consequently, a generator operating in parallel with another machine may lose voltage and become a motor driving its turbine against the flow of steam.

The subject includes the question of labor because with a machine of that kind you necessarily employ highly-paid engineers. For that reason, it has been desirable in my judgment to keep the character of all such apparatus as simple as possible, well within the knowledge and experience of the ordinary class of engineers who are likely to find employment in buildings.

Another feature in this plant is the use of a high tension of 250 volts on the electric service, which has nothing to do with the ventilating requirements excepting so far as to operate the motors at the very usual tension of 240 volts, but involves the use of the same high tension on the lighting system which would be extremely uneconomical.

MR. LEWIS: I might say that the electrical distribution there is simplified by the fact that very rarely, I suppose once or twice in a year, is it necessary to run both machines. The wiring is on a three-wire system, the light being at 110 volts and the higher voltage is used for power. The reason for that was a peculiar one. About eight or nine years ago I installed a plant at Galesburg, where I used a voltage of 110 volts. Three or four years later the board of education discovered that they were paying something like 8c. a kilowatt for the light in the other school. The city offered the board the free use of its poles if the board would run the wires from the other school plant, but they could not do it on account of the higher voltage.

Free Engineering

By George W. Knight and Perry West

Commenting on a practice that is not confined to any one branch of the engineering profession, but which is one, nevertheless, particularly characteristic of the heating trade the authors of the following paper, which was presented at the recent semi-annual meeting of the American Society of Heating and Ventilating Engineers, in Chicago, urge a stand which, it would seem, could be taken now by the profession, irrespective of the former necessity for such conditions as are described. Mr. Knight is the chief engineer for the Board of Education, of Newark, N. J., Mr. West being associated with him in this office. The principal portions of their paper are given herewith:

Free engineering does not mean what it literally expresses: namely, professional engineering services free of cost, but, as the subject of this paper, it refers to that portion of engineering work which is being furnished "apparently gratis" by certain manufacturers, contractors, etc.

The cause which has brought about the existing conditions where the engineer and the contractor are doing a large percentage of the engineering work, is based upon the old proposition of offering something for nothing. This proposition is alluring, and has proven quite effective, its effectiveness lying in the fact that the general public does not appreciate that this "nothing" really represents a percentage over the legitimate cost of apparatus or work, sufficient to maintain an engineering department for rendering this "something for nothing."

The evil effects of this practice are twofold, affecting chiefly the owner and the engineer. First, the owner, by either wittingly or unwittingly allowing the manufacturer or the contractor to perform his engineering services, increases the cost and reduces the quality of the work which he receives. The practical reasons for this are simple but conclusive. In order to render engineering services, the manufacturer and the contractor must add to the cost of their apparatus to the owner, in order to maintain engineering departments.

That the production cost of such engineering is high, as compared with that of the regular engineer's, needs no further argument than the fact that it is an intermittent side-line of work being carried on by those whose principal interests and qualifications are centered in their own particular line. That they are fully compensated for this work in proportion to its cost, is a simple, fundamental business proposition. That the services rendered are of an inferior quality naturally follows from the fact that the plans and specifications furnished must include a number of items such as pipe systems, duct systems, electric systems and other work, entirely outside of the manufacturer's and contractor's particular line, and upon which they cannot afford to expend the necessary talent and energies. It is folly to suppose for a moment that such plans and specifications are drawn so as to permit of fair competitive bidding, or that apparatus in which the manufacturer and contractor are particularly interested, will not be included, regardless of its adaptibility to the particular requirements; otherwise, who pays for the free engineering?

We intimate above that the owner maw act unwittingly in this matter, which means that his architect or agent may avail himself of this free engineering without the owner's knowledge, in which case the owner not only suffers all of the evil effects mentioned above, but pays besides an architect's fee on his engineering work equivalent to, or greater than, that necessary to employ a competent engineer. This should be plain enough to hard-headed business men, and to us engineers who know the cost of producing proper plans and specifications, is it too plain.

The owner may say very honestly that the quality of the work which he is receiving is satisfactory, but we believe that he is led to say this through his ignorance of what a better quality of equipment would really mean to the success of his undertakings. We feel that, on the whole, engineering work has risen to a comparatively high plane, especially within the last decade. We mean by this that the equipment of to-day is far superior to what we have been accustomed to in the past. This, however, may be said of the equipment of the past as compared with older and more antiquated work.

The degree of perfection in the attainments in this line, as in all other lines, is too apt to be measured by the layman in comparison with something inferior, instead of trying to measure by the best attainable.

As the representative body of equipment engineers, we are largely responsible for the perfection of attainment in our own lines. If we are not, then we are not endeavoring to perform our duty, or we are not equal to our task. In such a position, it is our duty to inquire as to how well our work is being done, and to develop such ideas as will best advance the interests of this work and our profession. In the first place, it is necessary, in order that any work be done well, that it be in the hands of unbiased, unrestricted, competent men. The supply of men who would measure up to this standard, we believe to be ample for all requirements, but in order to develop, protect and preserve such men, it is necessary that they secure the work and the compensation.

Second, the engineer is being deprived of a large portion of business, and in a great many instances is forced to reduce his legitimate fee for professional services, in order to secure some of the business that is being done "apparently gratis" by others. In addition, the reputation of engineering work in general is reflected upon, to its own discredit, by this character of work. The engineer is placed, in this connection, in much the same position as would be occupied by the doctor if the druggist should maintain a free physician's service by charging enough for his drugs to maintain the same, or as would be occupied by the manufacturer and contractor themselves, should the engineer manufacture and furnish free apparatus by charging enough for the engineering to cover the cost of these items.

The authors have discussed this subject very freely with many manufacturers and contractors, and are convinced that probably 50% of them are willing, yes, even anxious, to abandon the practice, provided the remaining 50% would do the same. They frankly admit the practice to be wrong, and harmful to the engineering profession, but they state that it is necessary for them to continue it in order to secure the business, for the reason that if they are called upon by an owner or architect to draw heating and ventilating plans and specifications, and refuse to do so, some one else will, and so secure the business. And here is where the engineers, by a little concerted action, could bring the remaining 50% into line.

Take, for example, the comparison referred to above, between the physician and the druggist, and the manufacturer and the contractor, and the engineer. How many physicians would recommend their patients to such a druggist for their medicines? Or how many manufacturers and contractors would recommend such an engineer?

In this connection, legislation would accomplish a great deal toward breaking up the practice of "free engineering." There does not seem to be any reason why engineers should not be registered, as are physicians and architects. Surely their field is of sufficient importance, and in a great many instances the lives of many persons are dependent upon an absolutely correct engineering design.

DISCUSSION

PRESIDENT BOLTON:—I recall this matter being brought before this society a number of years ago and exciting at that time quite a degree of attention. Some years ago one of

our college buildings in New York City required to be equipped with a heating and ventilating plant. The architect was a man for whom I had previously done some work and I naturally applied to him for an opportunity of designing this plant. He led me to his drafting room and showed me nine sets of plans which had been prepared by different contracting firms for various schemes of heating and ventilating that building. I roughly estimated the actual cost of each set of plans to be $160.00 for drafting services and, if overhead charges were added, I should say about $300.00 apiece would be the actual cost, making a total of $2,700 which the heating and ventilating contractors paid out to produce plans for one installation, only one of whom could possibly get it.

Inquiring further into the practice you will find it extends into other kinds of work such as, for instance, steel construction. One steel company employs a force of 160 draftsmen upon the details of steel frames for buildings only. A consulting engineer in New York told me that he had to draw plans for steel framing for buildings for 1% or he could not get the work.

Another professional engineer engaged in the same line is only able to make good and even his fees by taking the contractor's or manufacturer's plans and cutting down the amount of metal to the narrowest limits within the regulations of the Department.

It seems to me increasingly necessary for the manufacturers and engineers in the difficult branches of our profession to put our heads together and insist upon payment for plans and advice. Some of our fellow members in Philadelphia have already insisted on payment of 2½% on their figured cost for the plans and specifications which they prepared and I understand they have had no difficulty in securing payment.

I would not favor legislation as a remedy for this condition and I do not think there is much to hope for in the proposed licensing of engineers. We shall gain more in the end by simply bringing this question forward for discussion and ventilation.

MR. BRONAUGH: It appears to me that the matter requires principally a campaign of education, because the manufacturers would be the first ones to grasp at an opportunity of getting away from the practice.

MR. J. H. DAVIS: Speaking from the manufacturers' side, my observation is that it would be very difficult for the manufacturer to introduce any new system or anything of a similar character without making plans. The engineer, the architect or the master fitter will say, "How do we know that this is any good? You have got to guarantee it. Nobody knows anything about it. The only way for you to do is to give us plans and specifications and we will take our figures from them." I think that our president knows from his own experience how hard it was to have the best engineers recognize the principles of vacuum system heating until the responsibility of their operation was taken up by the manufacturers themselves. Recently, my observation of the blower system work is very much the same. The entire heating profession relies more or less on the blower companies for information and takes from them their guarantees and they have the blower companies make their layouts. Without that procedure the blower business would never have grown as it has.

I know from the manufacturers' side that they would be glad to get rid of this engineering expense. As soon as the architects ask enough commission or fees to hire capable engineers, they will do their own engineering, and the manufacturer will be glad to be rid of all engineering.

MR. W. M. MACKAY: Some manufacturers look upon the making of plans as an advertising expense, claiming that they gain more business by

properly designing and specifying their apparatus so that they can insure its perfect operation when properly installed. Consequently it seems to me this is something which will gradually work itself out.

PROF. HOFFMAN: I think we will all agree that the paper has the right trend, but I believe when it comes to legislation, or anything like that, we must rather undertake, as has been said, a campaign of education.

Vibration Caused by Ventilating Fans

Some ideas on the cause and cure of vibration from ventilating fans were brought out at the recent meeting of the heating engineers in Chicago. Prof. J. D. Hoffman, referring to a heating plant described by S. R. Lewis, opened the discussion:

PROF. HOFFMAN: I would like to inquire how the ventilating fans in the attic were supported without having the vibration from the fans affect the building or be noticed in the building. In one or two cases, I have noticed that ventilating fans placed in the attic were noticeably noisy or jarring, and the vibration was felt down through the other rooms.

MR. LEWIS: In the fireproof construction buildings, the fans are set on wooden timbers of yellow pine. There is no vibration in that building. But in the old building, the fans are supported on the main bearing wall, the fans being comparatively small. I think the fan in the old building has a 24-in. wheel. We have had no trouble from the fans when we supported them on the bearing wall all the way through.

I might speak of one experience I had in Chicago. We had a ventilated school building heated by direct radiation. The only place we could locate a fan was in the attic. We found that the main brick wall stopped at the ceiling of the first floor. We got next to the old walls and put down three large steel columns clear to the bottom beams, ran them to the attic and constructed on that steel platform the fans and motors. If the building should ever burn down that wall will remain standing there.

PROF. HOFFMAN: The reason I asked that question was that in one case I know of, a building was fitted at the center with heavy masonry walls from the foundation and the attic fans were set upon these walls. Yet the vibration was noticeable around the building and there was some noise to be detected in the various rooms.

MR. LEWIS: I do not think that would have happened if the fan and motors had been properly balanced and the speed not too high. I have a good deal of experience with attic fans and motors and have never had any serious trouble. I think once or twice we have had noise and have cured it by making the manufacturer give us a better-balanced fan.

MR. A. C. BURDICK: I was called in one time in connection with a church heating plant, where the fan was placed in the church tower on about the level of the ceiling. In that case the fan was set on a wooden floor with wooden joists, in practically a drum. By using a heavy thickness of felt and connecting the fan to the duct with heavy canvas and the motor set on heavy felt, the motor made more noise than the fan did. In fact, the motor made a noise that was heard in the building.

PRESIDENT BOLTON: I have supported fans on spring connections by placing the fan and framing on light I-beams extending from a wall to the top of the nearest column and have succeeded in operating large fans on the roofs of hotels in this manner without giving trouble on the floor below, the spring afforded by the beams taking out any vibratory effect on the building.

Heating and Ventilating a Large City Residence

INDIRECT HOT WATER HEATING SYSTEM, COUPLED WITH EXHAUST FAN, IN RESIDENCE OF WHITELAW REID, NEW YORK

See Pages 34-35 for General Layout of Heating System

The New York home of Whitelaw Reid, United States Ambassador to England, is the south portion of a pretentious four-story and basement building which combines in one structure three separate residences. The building is located at the northwest corner of Madison avenue and Fiftieth street, New York, each residence having a main entrance opening into a common courtyard. The building is constructed with a central portion and two wings; the southern wing is Mr. Reid's residence.

With the exception of a seven-story extension on the Fiftieth street façade, the building is not a new one, and has been heated for years by means of an indirect steam heating system. When the question of heating apparatus for the seven-story extension was discussed, a hot water system was decided upon, despite the height of the extension. At the same time it was decided to remove the steam heating apparatus from the old portion of the residence and provide in its place a thoroughly modern hot water heating plant.

Within the past year the new heating system has been installed. In addition a system of ventilation has been put in for the music room, kitchen and interior store rooms, toilets, etc. The arrangement includes vent flues which are carried to the attic where they are connected to an exhaust fan, driven by a direct-connected electric motor.

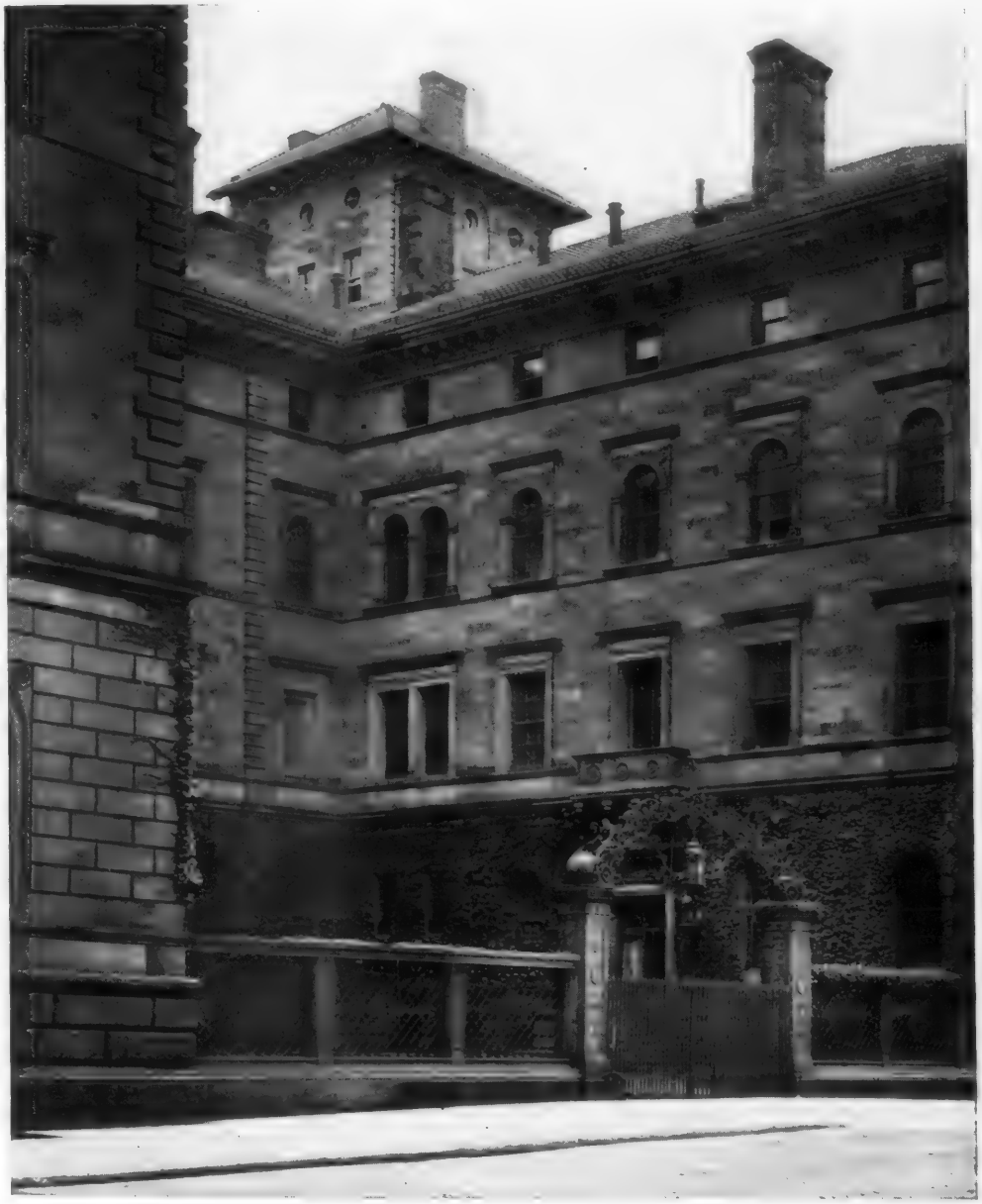
Owing to the unusual shape of this residence, having three exposed sides, it was possible to locate four fresh-air intakes on its three sides so that sufficient air supply is obtained, irrespective of the direction of the wind. The plant as installed contains a number of unusual features, not the least noteworthy of which is the use of steam delivered through the mains of the New York Steam Co., which, after being reduced to about 5 lbs. pressure, is connected to the two convertors which furnish the hot water supply for the heating system. High pressure steam is supplied to the steam coils for the laundry dryers and also for the two hot water tanks for the plumbing system.

The general arrangement of the heating system, unusually complete for a building of this character, may be seen from the accompanying plans. An Ideal sectional cast-iron hot water boiler is installed for emergency use. The hot water convertors are installed in duplicate, one being of sufficient capacity to supply the entire heating needs of the enlarged residence. These convertors are of the

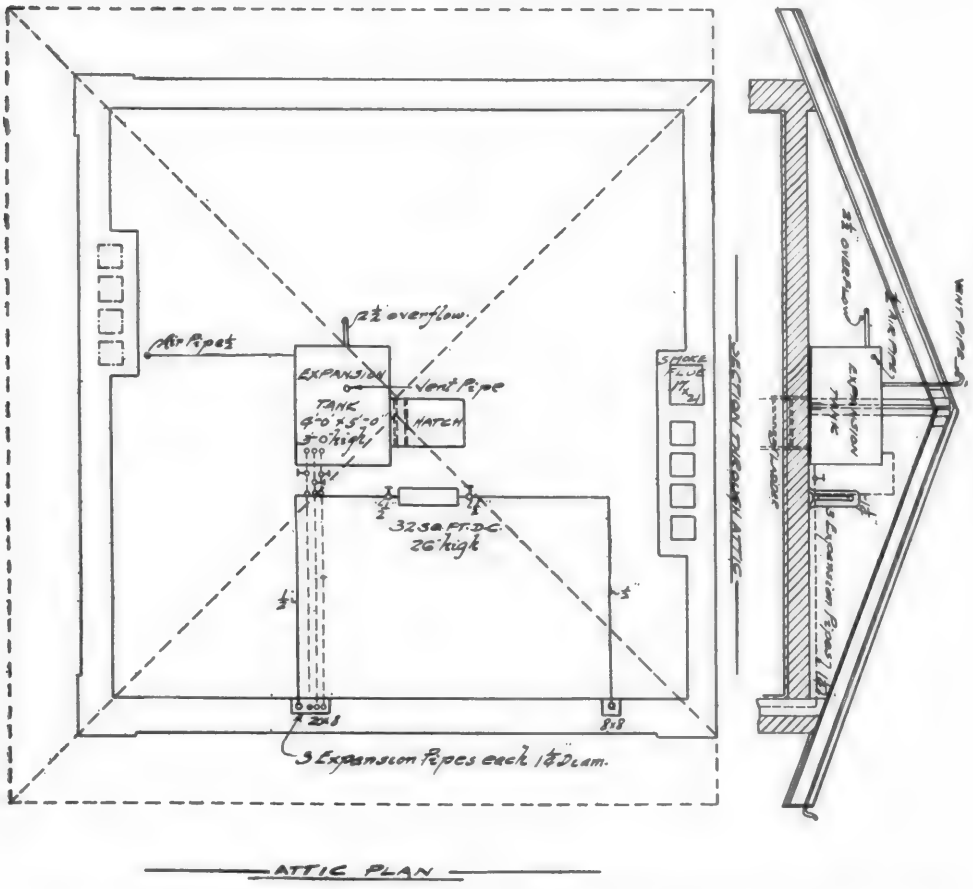
FIFTIETH STREET SIDE OF RESIDENCE OF WHITELAW REID, FROM VIEW TAKEN DURING ALTERATIONS

Goubert feed-water type. Each convertor contains 233 sq. ft. of heating surface, consisting of 90 1¼-in. seamless drawn brass tubes expanded at the ends into steel tube sheets. The shells and water chambers are of heavy cast-iron and are provided with large outlet for large flow and return mains. The shell of each convertor is 25 in. in diameter and the tubes are 96⅞ in. long. The convertors are supported on cast-iron saddles and rest on brick foundations.

Steam enters the building through the main of the New York Steam Co. It is then passed through a 4-in. x 6-in. Kieley pressure reducing valve, provided with a by-pass and three valves, and flows thence to the convertors. The water of condensation is discharged through a 4-in. Utility chronometer valve to a No. 3 Utility



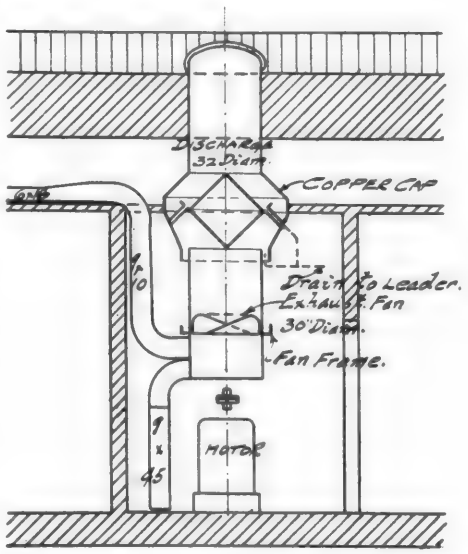
RESIDENCE OF WHITELAW REID AT MADISON AVENUE AND FIFTIETH STREET, NEW YORK



PLAN OF ATTIC, WHITELAW REID RESIDENCE, SHOWING EXPANSION TANK AND CONNECTIONS

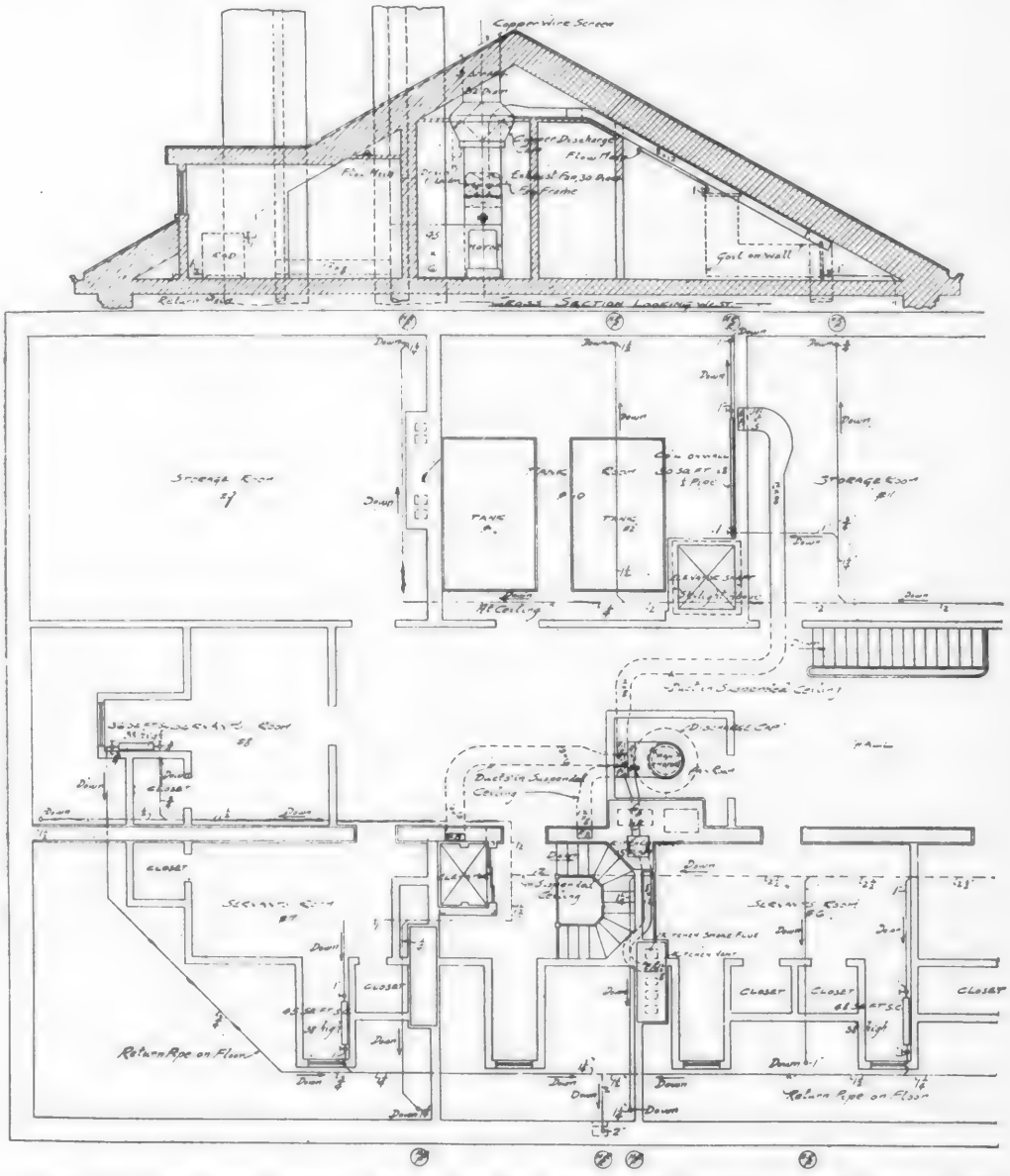
pump governor, thus maintaining a sealed water level. The water condensation is then passed through a cooling coil to reduce its temperature to the proper point before it passes to the sewer. The cooling coil is made up of two 4-row sections, each 8 ft. long and 3 ft. wide and is of the Sturtevant St. Louis type. The coil is provided with a by-pass and three valves. Through this cooling coil is also passed the water of condensation from the laundry dryers and the hot water boilers of the plumbing system. Contrary to usual methods, the New York Steam Co. supplied, instead of its usual St. Johns steam meter, a water meter for measuring the rate of condensation.

From the boiler and from each convertor are run three 1¼-in. expansion lines independent of each other and



DETAIL OF EXHAUST FAN, WHITELAW REID RESIDENCE

connected to the expansion tank in the attic of the new building. The expansion tank is 4 ft. wide by 5 ft. long by 3 ft. high and is provided with a 2½-in. overflow pipe connected to the nearest leader and a ½-in. signal pipe as indicated on the cellar plan. The air passes through cheese cloth filters and thence, through cold-air ducts, to the indirect heating stacks. All fresh-air chambers are connected together with galvanized iron ducts, so that the



PART PLAN OF FIFTH FLOOR, WHITELAW REID RESIDENCE, SHOWING VENT DUCTS AND EXHAUST FAN

down to the cellar. It is provided with an automatically controlled cold water connection and a vent pipe.

INDIRECT HEATING SYSTEM

The indirect heating system is connected to four fresh-air inlets, located as indicated on the cellar plan. The air passes through cheese cloth filters and thence, through cold-air ducts, to the indirect heating stacks. All fresh-air chambers are connected together with galvanized iron ducts, so that the supply of fresh air is independent of the direction of the wind.

The indirect heating stacks are made up of Vento indirect radiators spaced 4 in. on centers and are suspended from the ceiling. All of the

rooms are supplied with indirect heat except the servants' bedrooms, which have direct radiators of the Peerless pattern, sectional type, with threaded nipples.

The Johnson system of temperature regulation is installed in connection with the indirect heating apparatus. There are 32 thermostats controlling 37 heat sources. Among these are two hot water thermostats controlling the steam and return valves for the hot water convertor so that the water in the heating system can be maintained at any desired temperature between 100° F. and 200° F. One hot water thermostat controls the damper in the smoke connection and ash-pit door of the hot water boiler. The indirect heating stacks are controlled by diaphragm dampers in the hot-air connections leading to the rooms to be heated.

The kitchen and various rooms in the basement, as well as the interior toilets on the other floors, are provided with exhaust flues which are carried to the attic in the old building. Here they are connected to a 30-in. Blackman fan, with direct-connected electric motor, and having a copper discharge cap arranged as shown in the sectional view.

At the ceiling of the music room is an ornamental rosette with openings which are connected with an exhaust duct leading to the attic whence the vitiated air is discharged through a copper discharge cap.

The architects are Messrs. McKim, Mead & White, New York. Messrs. Nygren, Tenney & Ohmes, consulting engineers, New York, designed the above-described apparatus and superintended its installation. The contractors for the work are Baker, Smith & Co., New York.

Future Use of Soft Coal in New York

Discussing the subject of smoke prevention at the recent meeting of the heating engineers in Chicago, President R. P. Bolton said that the time is rapidly approaching when New Yorkers will be compelled to make use of soft coal.

The price of hard coal, he said, has been advanced this season 25 cents a short ton on all the smaller and cheaper grades and it is expected that each year will see an equal increase in price which will soon bring the cost of hard coal to such a high figure that it will be necessary to burn, first, mixtures with soft coal and, finally, soft coal altogether, as the card coal supply gradually gives out.

"It is not too much to say," continued Mr. Bolton, "that there is not one boiler in one hundred in New York City that is set in the proper manner so as to make proper use of the mixtures of hard and soft coal, let alone the exclusive use of soft coal. So that the conditions of things in New York will eventually be serious and will have to be dealt with in the not very distant future.

"The great trouble I have noticed in connection with such boilers as do use soft coal in New York is that the boilers are all set too low, a condition that is very common, and one which frequently leads to disastrous results. A boiler set too low upon the furnace reduces the furnace temperature and, in the case of water tube boilers, the inclination of the tubes brings the comparatively cold tube surfaces against the gases that are being distilled at the rear part of the furnace, chilling the gases and preventing their combustion.

"An instance in point is the experience gained in connection with the water tube type used for marine purposes. The Plant Line steamship La Grande Duchesse was originally equipped with water tube boilers of the Babcock & Wilcox type, the tubes being inclined from the front to the rear of the furnace in the then usual manner. It hap-

pened to fall to my lot to find out what was the trouble with the boilers, which brought about a great waste of fuel and emission of smoke and even of flames, the vessel having been seen in New York harbor with flame reaching 20 feet high above the stack. After observations, I made the suggestion that the boilers either be raised 1½ ft. or turned around end to end. The latter course was eventually followed with this type of marine boiler and now thousands of horsepower are in use and are very good smoke-consuming devices.

"In connection with the same general subject I have been interested in comparing the amount of light provided by nature and the amount of artificial light used in its absence. My observations of a number of buildings have shown that as the intensity of light varies, so the use of electric light varies. In making similar inquiries in Chicago I found that the intensity of sunlight varies very much from that in New York, the sunlight in the early morning as compared to that of New York City being less in degree. I found that this lack of light corresponded with a large amount of electric lighting, evidently used to make up for the limited degree of sunlight. The Weather Bureau informed me that this deficiency of sunlight was due to the pall of smoke gathered over the city during the night, which would continue to hang over the city during the early business hours of the day, or until some breeze had blown it away. So you will see that we pay directly for the production of smoke by an additional use of electric light."

Mr. Bird: I have estimated that there are about 10,000,000 tons of coal burned each year in the city limits of Chicago. Mr. Bolton figures that the corresponding figures for New York City are 17,000,000. Per capita, the figures for Chicago are a little higher, but I believe both figures are right in spite of that. Within the city limits of Chicago there is probably more manufacturing proportionately than in New York. So I think we do use more coal per capita in Chicago than in New York. The coal used in Chicago also may be of less thermal value per ton.

Our estimate of the coal consumption was made for the purpose of deciding where the smoke came from that is made in Chicago. We divided all the users of coal into seven classes and then we made thousands of observations of the density of smoke made by the plants in these various classes. With those data, together with the total coal consumption in each class, we were able to compute the amount of smoke made by each class. The results showed that the railroads in Chicago make 43% of the total smoke produced in the city. That seems like a generous proportion because they burn only 18½% of the coal consumed. Of course, our railroad situation is quite different from that of New York City. Here we have over 30 different railroads operating in Chicago. We have about 25 trunk lines, besides a number of transfer or belt lines. They are operating about 1,500 locomotives all the time in the city over about 2,200 miles of track.

The next largest producers of smoke in Chicago are the miscellaneous power plants, which include high-pressure plants such as factories, mills and all stationary power plants that are making steam for use as power. The third largest smoke producers are the special furnaces, like those in our steel mills, the reheating furnaces and the terra cotta plants and brick yards and all plants that burn coal for making heat that is not used in connection with steam power.

The fourth largest smoke producers are the heating plants in the central district. The river craft make 4%. The coal used in flats and for domestic heating makes only about 4½%. This figure refers to

plants used primarily for heating homes and apartment houses. This percentage is surprisingly small, but the smoke they make is more objectionable than the smoke made by the large factories, because it is emitted a relatively short distance from the ground and in the residence neighborhoods. The amount of coal used in domestic heating is about 15%. That refers strictly to homes.

Ohio's New Building Code

COMPULSORY VENTILATION REQUIRED IN THEATRES AND ASSEMBLY HALLS AND IN ALL SCHOOL BUILDINGS, PUBLIC AND PRIVATE

A new building code for the State of Ohio, passed May 31 last and approved by Governor Harmon June 14, is a lengthy and impressive document, regulating the construction, etc., of public and other buildings, including theatres and assembly halls, churches, school buildings, asylums, hospitals and homes, hotels, lodging houses, apartments and tenement houses, and club and lodge buildings. Special sections contain regulations for the sanitary condition of such buildings and under these sections provision is made for the mechanical ventilation of all theatres, assembly halls and school buildings in the state. The provisions relating to theatres and assembly halls are as follows:

THEATRES AND ASSEMBLY HALLS

A heating system shall be installed which will uniformly heat all parts of the building to a temperature of 65° F. in zero weather.

All parlors, retiring, toilet and check rooms, and all assembly halls used in connection with and a necessary adjunct to a church, school building, lodge building, club house, hospital or hotel shall be heated by an indirect system combined with a system of ventilation which will change the air not less than six times per hour. All other assembly halls and theatre auditoriums shall be heated and ventilated by a system which will supply to each auditor not less than 1,200 cu. ft. of air.

The system to be installed where a change of air is required shall be either a gravity or mechanical furnace system, gravity indirect steam or hot water, or a mechanical indirect steam or hot water system.

No stove or open grate shall be used in any theatre or assembly hall, except water heaters, furnaces and boilers.

No stove pipe shall be more than 5 ft. long, measuring horizontally, unless the same be enclosed in a standard fireproof heater room, nor shall any stove pipe come closer to any combustible material or ceiling than 3 ft.

The fresh air supply shall be taken from outside the building and no vitiated air shall be reheated. The vitiated air shall be conducted through flues or ducts to and be discharged above the roof of the building.

No floor register for heating or ventilating shall be placed in any aisle or passageway.

No coil or radiator shall be placed in any aisle or passageway used as an exit, but said coils and radiators may be placed in recesses formed in the wall or partitions providing no part of the radiator or coil projects beyond the wall line.

In this connection, it is stipulated that in the case of moving-picture shows, the booth in which the motion machine is located shall have an opening not less than 10 in. in diameter for ventilating, which shall be flanged to carry a standard conductor pipe for exhausting the hot air generated in operating the machine. Connection shall be made with chimney or the outer air. Conductor pipe shall be riveted together, and outer end arranged so that escaping gases or flames will not come in contact with combustible material.

SCHOOL BUILDINGS

The provisions for the heating and ventilation of school buildings are almost as explicit. They are as follows:

A heating system shall be installed which will uniformly heat all corridors, hallways, play rooms, toilet rooms, recreation rooms, assembly rooms, gymnasiums and manual training rooms to a uniform temperature of 65° F. in zero weather; and will uniformly heat all other parts of the building to 70° F. in zero weather. An exception is made in the case of rooms with one or more open sides used for open air or outdoor treatment.

The heating system shall be combined with a system of ventilation which will change the air in all parts of the building except the corridors, halls and storage closets not less than six times per hour.

The heating system to be installed where a change of air is required, shall be either standard ventilating stoves, gravity or mechanical furnaces, gravity indirect steam or hot water; or a

mechanical indirect steam or hot water system.

Where wardrobes are not separated from the class room they shall be considered as part of the class room and the vent register shall be placed in the wardrobe.

These wardrobes are separated from the class rooms, they shall be separately heated and ventilated the same as the class rooms.

The bottom of warm air registers shall be placed not less than 8 ft. above the floor line, except foot warmers which may be placed in the floors of the main corridors or lobbies.

Vent registers shall be placed not more than 2 in. above the floor line.

The fresh air supply shall be taken from the outside of the building and no vitiated air shall be reheated. The vitiated air shall be conducted through flues or ducts and be discharged above the roof of the building.

A hood shall be placed over each and every stove in the domestic science room, over each and every compartment desk or demonstration table in the chemical laboratories and chemical laboratory lecture rooms, of such a size as to receive and carry off all offensive odors, fumes and gases.

These ducts shall be connected to vertical ventilating flues placed in the walls and shall be independent of the room ventilation as previously provided for.

Where electric current is available, electric exhaust fans shall be placed in the ducts or flues from the stove fixtures in domestic science rooms and chemical laboratories, and where electric current is not available and a steam or hot-water system is used, the main vertical flues from the above ducts shall be provided with accelerating coils of proper size to create sucient draft to carry away all fumes and offensive odors.

The code applies not only to public school buildings, but to all parochial and private schools, colleges, academies, seminaries, libraries, museums and art galleries, including all building or structures containing one or more rooms used for the assembling of persons for the purpose of acquiring knowledge or for mental training.

The enforcement of the new law, as regards its heating and ventilating provisions, is placed in the hands of the chief inspector of workshops and factories or building inspector, or commissioner of buildings in municipalities having building departments.

Failure to obey the provisions of the act or any order of such officers is made a misdemeanor and conviction will entail a fine of not more than $1,000. Any architect, engineer or contractor violating or assisting in the violation of any of the provisions of the act is subject to similar punishment.

New Building Trades Association in Chicago

A new central body in the building trades of Chicago, known as the Associated Building Trades, has been formed to take the place of the Building Trades Council, as the result of the factional fight between the plumbers and steamfitters of that city. In this fight certain unions in the Building Trades Council which have aligned themselves on the side of the steamfitters have now withdrawn and have formed the new organization. Peter Shaughnessy, president of the Bricklayers' and Stonemasons' Union, has been elected president.

The unions, with their membership, in the new council are:

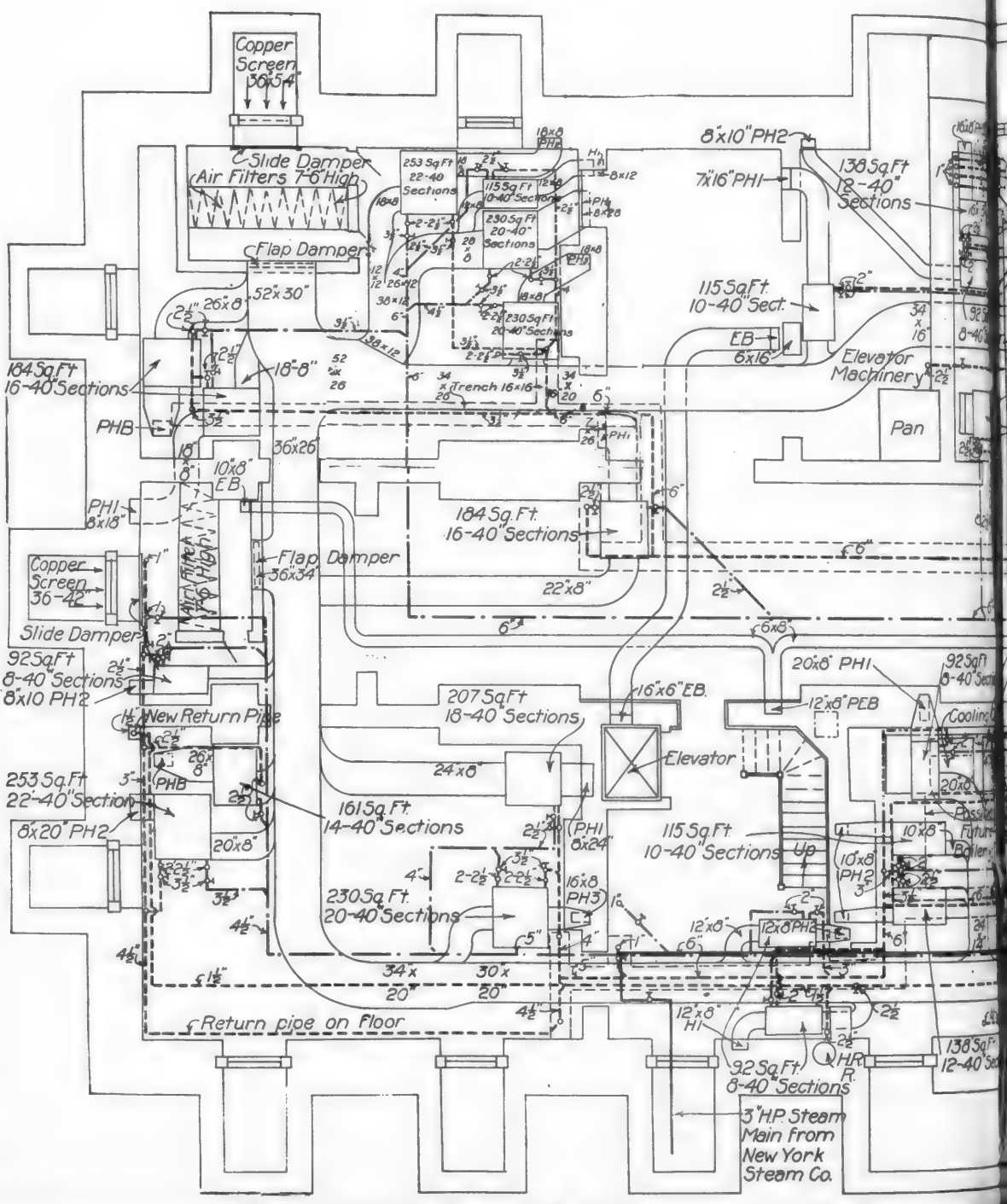
Boilermakers	250
Boilermakers' helpers	250
Bricklayers and stonemasons	8,000
Carpenters	17,500
Hoisting engineers	250
Glassworkers	400
Glaziers	500
Lathers	600
Mosaic workers	300
Mosaic workers' helpers	300
Plasterers	1,700
Roofers and helpers	400
Tile layers and helpers	150
Building laborers	17,000
Steamfitters	650
Junior steamfitters	650
Total	49,900

Besides the organizations in the new central body, the following are either sympathizing with its purposes or remaining neutral:

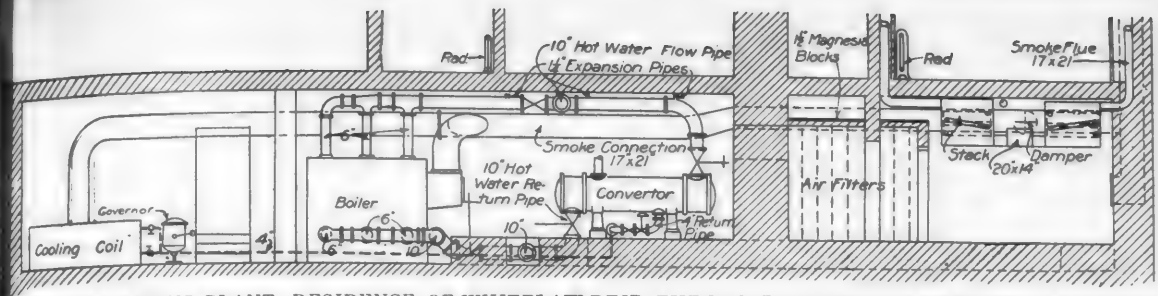
Painters	10,000
Structural iron workers	900
Marble cutters and setters	400
Other trades	6,000
Total	17,300

The unions remaining in the old council and which are friendly to the plumbers are the sheet metal workers, machinists and electricians.

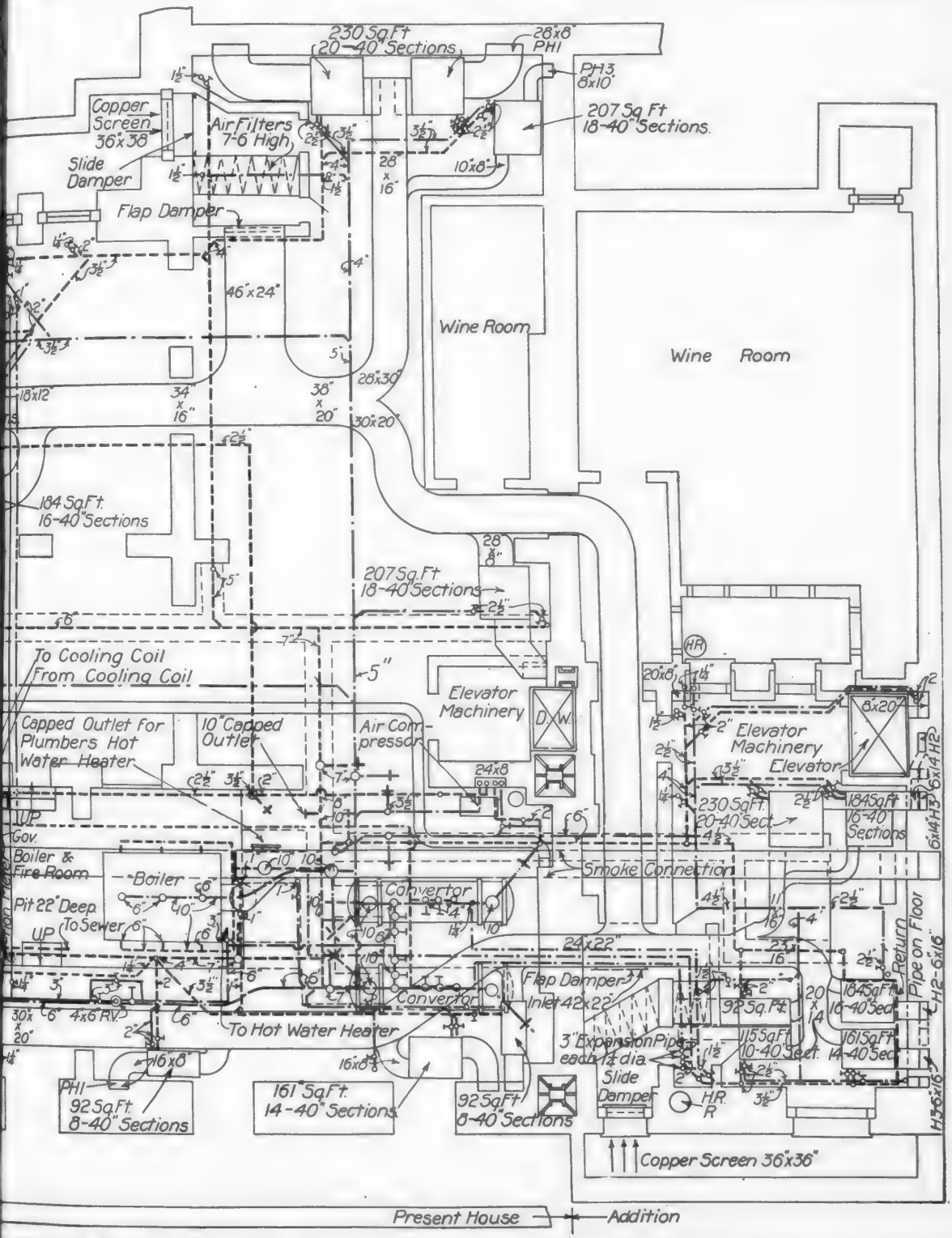
As already outlined in these columns the factional fight between the plumbers and steam fitters of Chicago arose through an effort on the part of the United Association of Plumbers to enlarge their organization to embrace the local steam fitters. Upon the refusal of the steam fitters as a body to amalgamate with the plumbers, the latter organized a steam fitters' union of their own and the clashes brought about through these two conflicting unions has been responsible for the tying up of work on upwards of 500 buildings besides resulting in considerable violence.



CELLAR PLAN OF THE WHITELAW REID RESIDENCE, NEW YORK, SHOWING HOT



ATION OF HEATING PLANT, RESIDENCE OF WHITELAW REID, THE BOILER BEING FOR EMERGENCY USE ONLY



R HEATING SYSTEM, THE WATER BEING HEATED BY STEAM THROUGH CONVERTORS

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THE public press has long since found it well worth its while to turn to the technical press for news relating to engineering operations or, at least, for confirmation of such news. This caution has so often been justified by the event that one would think the metropolitan papers would be the last to make random statements on engineering subjects. Yet the grave announcement was recently published in the New York dailies, under suitable headlines, that the well-known cooling plant in the New York Stock Exchange has been permanently shut down. While the direct cause was not disclosed, the intimation was given that the system did not preserve the desired degree of freshness in the air, for the reports stated that a burst of cheers from the assembled brokers greeted the opening of the long-closed windows.

The abandonment of so important a plant, presumably through no fault in its design or operation, appeared to be a calamity that called for a prompt investigation as constituting, if true, the most staggering setback in this line that the engineering profession has experienced in many years and one that might have a serious bearing on the development of standard cooling practice. We are gratified, however, to be able to state that the shutdown, so far from being permanent, was quite temporary, being due to the rather prosaic cause of the city's low water supply. The recent rains have entirely remedied this difficulty and the plant, we are informed, is again in full and successful operation, to the undoubted relief of an anxious profession and to the confusion of all carping critics.

A PERUSAL of Ohio's new building code, which is now at hand, discloses the fact that the code covers the ventilation, not only of theatres and assembly halls, but of school buildings and other institutions of learning, both public and private. In its requirements for private educational institutions the code goes further than any of the present statutes on the subject, with, possibly, the single exception of that in Massachusetts. There the law for private schools applies to those seating ten or more persons at one time, but no specified amount of fresh air is named, the only condition being that the method of ventilation shall be included in the plans deposited with the inspector. It would thus seem that for explicitness the Ohio building code, with its provision for six changes of air per hour for all schools, marks the most advanced step yet taken in the way of compulsory ventilation. The sections containing the heating and ventilating requirements referred to are reproduced in this issue.

Central Station Heating

By Byron T. Gifford

6—Management

(Previous articles in this series: "Pipe Line Losses from Radiation," April, 1911; "Rates," May, 1911; "'Ready to Serve' or 'Maximum Demand' Rate," June, 1911; "Operation," July, 1911; "Pipe Line Losses from Friction," August, 1911.)

The management of a public utility requires system as well as a lot of good common sense. The extent of the system that can be profitably utilized depends a lot upon the size of the utility. In other words, an elaborate system would be decidedly detrimental in a small organization, for there would not be sufficient employees to handle it and keep it going, to say nothing of keeping the plant itself going. Any system is liable to get top heavy if too elaborate and, on the other hand, a management without a system or plan of operation is an absolute failure.

To find the system best adapted to each case requires thought and study and, as stated, a good portion of common sense.

A good definition for the word system as used by public utility managers is "A plan of management," a general rule or set of rules guides the management of a property. The plan, or, at least, each one's part in it, should be indelibly stamped on every employee's mind. It should be easily understood and made plain to every man or woman in the organization.

It has been said that in unity there is strength. We cannot have unity without organization and we cannot have an organization without a system. System is as necessary in a public utility organization as laws are in a state. Without laws in a country we have anarchy and without system in a utility management we have failure. We have reached a point in public utilities where every manager realizes this point so that little can be said to strengthen the argument.

In adopting a system there are a few general points to be observed and kept in mind. The object of the system is to develop the utility to the best possible condition, both with respect to its physical condition and its financial condition.

In order to develop and maintain a good physical condition it requires experience and careful detail management.

To develop a good financial condition requires sometimes more than human effort can produce. But in many cases system will bring the desired result, provided, of course, that it is a possibility.

A central heating plant has three general features, like any other business:

First—We must manufacture our product, heat, as cheaply as possible.

Second—We must transport or distribute heat economically.

Third—We must make our product attractive.

Our field is limited to the city or district in which we are doing business and we are limited to this field. There is a definite and fixed number of consumers and a definite and fixed amount of business to be obtained; consequently, one important fact presents itself; never lose a consumer if you can keep him by reasonable and consistent means.

Owing to the peculiar attribute called human nature there are some people who cannot be satisfied and whom you cannot expect to keep as consumers, even if you are able to serve them originally. These people should be treated nicely, but forgiven and forgotten as soon as possible.

As a rule, quality of service is remembered long after the price is forgotten, so every means to give the best service should be employed. The price should be kept as low as can be done consistently without interfering with the good service necessary. The competition of the isolated heating plant is always sufficiently strong to prevent any danger from exorbitant charges. If a man can heat his building for $50.00 per year, it is difficult to get him to pay you $100.00, but do not overlook the fact that you heat him perfectly for 24 hours while he has been heating himself only part of the 24 hours. Remember, also, that after you have heated him perfectly for one season you have a lifelong consumer.

Now the point arises, how to give the consumer perfect service. This requires station capacity, pipe line capacity and sufficient radiation capacity in the consumer's property to give him sufficient heat. It often requires that attention be given to the condition of the consumer's buildings to see that windows are kept in proper repair, that bad and defective construction be remedied, that unnecessary ventilating ducts, such as chimneys, are closed tight and that wasteful methods of using heat be stopped. This should be done whether the heat is sold on a flat rate or meter basis. Of course, if the defect lies in the station or pipe line, it is obligatory on the part of the utility to remedy the trouble at once. If the defect is on the consumer's premises it is for the consumer to fix, but the utility management should guide the consumer in these necessary repairs and insist that the repairs be made without delay.

If the consumer's premises are in proper shape and proper repair over half the battle is won, but it often takes tact and untiring efforts to bring about this result. There are no set of rules that can be set down to guide the manage-

ment in this task. One thing can be noted, however, that if the management is doing all it can to remedy these little troubles, the consumers, if properly handled, will ordinarily meet it half way.

Do not suggest a repair unless you know it will be helpful to the cause. If you do you will lose the confidence of the consumers and nothing is as essential as the consumer's confidence in the management.

General rules and principles for pipe line troubles and repairs have been given under "Pipe Line Operation."

As to the system to be followed in the heating station so as to manufacture heat economically, a great deal can be said, but the operation of a heating station is so similar to the operation of any fuel-burning plant and these principles have been so generally expounded that it is considered needless to go into them in detail here.

A few of the more important points will be mentioned because they are so important and because they should be kept in mind.

The care of the boilers is very important. The management should know that the boilers are kept clean and should have a record kept of the time each boiler is cleaned. Do not depend on the record to know that they are clean, but see to it that they are cleaned both inside the tubes and outside. A personal examination of the boilers by the manager or his superintendent is often advantageous, especially to prove beyond a doubt that the system of watching this one point is working.

No boiler can be too clean. The combustion of the fuel is also very important and a system can be adopted that will materially advance economical operation. Flue gas analysis is essential in this connection. The check this has on the firemen is far reaching. It shows what economy is obtained and allows the weak points to be discovered and remedied. The point to be watched by the manager is that these tests are made regularly and a record kept so that they may be referred to at any time. It is often advantageous to work out a system of credits and debits which will increase or decrease the fireman's wages in proportion to the economy he develops. In a heating plant so great a percentage of the operating expense is fuel that a small leak in this department often means financial failure.

The kind of coal to burn, if a coal-burning plant, is decidedly important and the author's experience has been that an operating test is the only sure method of ascertaining which size and which quality of coal to buy. By operating test is meant a test that takes into consideration every possible phase of the operating condition, such as cost of fuel per 1000 lbs. of steam, or 1,000,000 B. T. U. generated by the boilers; the effect on the grates or stokers; the han-

dling of the ash; the labor handling the fires with the coal, etc. This test is invaluable to the manager and when the best grade and size of coal are known, a great deal of trouble and dissatisfaction is stopped.

This is one of the most difficult things a manager has to decide and, in order to decide it, a system must be used and used effectively.

In order to determine the cost to generate 1000 lbs. of steam or 1,000,000 B. T. U., it is necessary, of course, to measure the output of the plant. This can be done in a steam plant by measuring the boiler feed water and taking the temperature of the water before it enters the heater, or economizer, or by meter direct. In a hot-water plant the amount of water flowing should be measured and the temperature of the water, both flow and return, should be recorded. Recording meters and thermometers are made for this purpose and are very reliable. It is also necessary to keep a record of the weight of coal burned and, oftentimes, to keep a record of the ash removed, the number of times the boiler needed cleaning, the amount of time consumed in firing, cleaning fires and removing ashes. In this way the general result can be obtained in each of its separate parts and for each different grade of fuel.

The same system can be adopted in handling the machinery. A record should be kept of the time devoted to the repairs and maintenance of each piece of machinery, the amount of oil used and the cost of new parts. It does not take much of the fireman's time nor much of the engineer's time to keep these records and they are invaluable to the manager.

The manager should keep posted as to the weather. What the weather is going to be and what it has been. It is important to know if a cold wave is expected so that every part of the plant can be ready for it. The local forecast furnishes this information to a great extent. The advantage to be gained by a record of the weather (temperature, wind and humidity) that has passed, is of special benefit in handling complaints about extremely high monthly bills. In this connection it might be mentioned that a real live manager soon learns the habits of each consumer as to his economy or wastefulness in using heat. This is an important point and one that should be studied by every manager.

Recording gauges and thermometers should be used on every vital part of the system so that the manager can have a check on the operation of the plant at all times, and in that way can decide whether a complaint as to insufficient heat is justified or not.

The maintenance of the pipe line is not a large item of expense at any time, but it is decidedly important. If a leak

develops it can cause expensive trouble and should be fixed at the earliest possible moment. It not only wastes heat, but it has an exceptional deteriorating effect on the pipe and insulation. Expansion devices should be inspected regularly. Line traps and meters should also be watched and kept clean.

The consumer's equipment should be examined regularly. The meters and traps should be inspected and kept in good repair. Do not wait for a complaint before doing this. Do it of your own accord as it will win you a lot of friends and will materially reduce the number of complaints.

One of the greatest sources of complaint any utility can experience is that caused by the procrastination of its employees. If you have a complaint, remedy it at once or, at least, attempt to remedy it. Do not try to mislead your consumers. Be prompt and impress it upon your employees that proscrastination will not be tolerated.

New Business Department

This branch of central heating is especially important in a new plant. A heating plant designed to handle 200,000 sq. ft. of radiation cannot be made to pay with a small load connected; for that reason it is essential to load the plant as soon as possible. A new business campaign can be inaugurated that will pay big. Good, catchy advertisements will help and so will a personal canvass by the solicitors and the manager. Each particular case should be carefully handled and the manager can afford to give this department a large share of his time, especially after the plant is shut down in the spring.

Central heating is very attractive and after a consumer once has it he very seldom discontinues it, if the service is properly maintained. One satisfied consumer will bring you more, so do not be afraid to refer to your consumers as references. After a plant has been in operation a season or two, advertising will not bring large results, but the first year or so it helps wonderfully for it educates the public to see what a comfort and pleasure you have for them.

This branch of the business has been given a great deal of thought and study the last few years, and the results obtained are indeed gratifying.

The development of new business in central heating is more or less limited as compared with electric light and power. In a territory such as a central heating plant would serve, there is a greater volume of heating business than there is of electric business. This is especially true of the business district in a city and also true of the residence section. There are, of course, sections in every city where this is not the case, where large power loads are developed. From the above fact the electric end of a by-product plant

should extend into territory beyond the heating zone or, in other words, in order to keep the two loads well balanced it is often necessary to put a great deal of effort in the new business department of the electric plant to keep pace with the heating requirements.

Do not consider, however, that the heating business does not need attention for it does, although I think there is less trouble, per dollar invested and per dollar earned in a heating plant than any utility I know of, if the property has been built right at the start.

Another point which makes the new heating business department of a by-product plant necessary is the fact that all electric consumers are using more current per consumer than they used to. The introduction of fans, irons, washing machines and the like are developing the electric loads rapidly, thus allowing more waste steam to be used in the heating plant and, as it is desirable to make the heating plant earn as much per foot of pipe line as possible, it is better to develop the territory already served than to construct new lines. While our field is more or less limited to a given territory, a wonderful amount of business can be developed if the proper effort is made. The domestic hot water can be heated by the central station service and store windows properly heated and ventilated will be free from frost.

There are, of course, no bargains to be offered the consumer from time to time to induce new consumers to connect to the plant, but the comfort to be derived from the service is an inducement sufficient to bring a large volume of business, if the proper effort is made to acquaint the people with the facts. What can we imagine more delightful than a home heated evenly and sufficiently all winter from the time heat is needed in the fall until it is not needed in the spring, with a supply of heat that heats every room in the home at any time of day or night, with a supply of hot water for bath purposes always ready, with a supply of heat sufficient to heat any fresh air needed for ventilation and all this without one iota of trouble or annoyance to the consumer? Even though it does cost a little more than the isolated plant per year, which, by the way, is not always the case, the difference in cost is nothing when the additional comfort is taken into account.

In this article the author has tried to bring out a few of the important points in the management of central heating plants, but, after all is said and done, a lot of good business judgment will do more to attain success than anything else. A central heating plant is probably as easy to run as any utility. If any operator or manager gets a new thought or a new idea from this article its mission will have been accomplished.

Novel Experiments Being Conducted by the Chicago Ventilating Commission

In an especially fitted schoolroom of the Chicago Normal School some experiments in ventilation are being conducted by the Chicago Ventilating Commission in accordance with many of the ideas advanced by Dr. William A. Evans, until recently commissioner of health for that city.

As outlined by Samuel R. Lewis, the commission is seeking means to improve the air distribution, both in buildings heated by direct radiation and those mechanically ventilated.

"We found," said Mr. Lewis, "that we did not get air distribution unless the air was introduced much warmer than with ordinary outlets and inlets. In order to study this matter we have taken a standard class room and put in a false floor and ceiling, the false floor being raised up 16 in. from the floor. Under every desk is placed a 3-in. pipe. The air is introduced through these openings, numbering about fifty, one for each occupant of the room and is taken out through four openings in the false ceiling below the normal flow of air into the room. The room is occupied by adult people.

"By keeping careful record of the temperature of the air and by taking CO_2 samples and analyzing them as well as the dust by means of special apparatus provided by the Board of Education, and also by keeping a record of the health of the occupants, we will have, in the course of a year or two, some interesting and valuable data. I think that is the coming way to ventilate a room, because much of the time it is necessary to introduce the air at a temperature below the temperature of the room itself. The usual method of bringing the air in at the top and taking it out at the floor does not work when the air is introduced cooler than the air in the room."

Ventilation and Labor Efficiency

In a report made to the International Congress on Industrial Diseases, on the health of men working underground, Dr. Langlois, of Paris, gives some interesting facts relative to the effect on mine workers of humidity, temperature and air circulation. According to investigations made by Dr. Langlois he found at Ronchamps at a depth of about 3,280 ft., with the humidity such that the dry bulb showed 36.5° C., and the wet bulb 24.8° C., that work could be carried on, but that, when the humidity became greater even with a lower temperature, work became difficult. He found that with temperatures above 25° on the wet bulb, the ventilation has a marked effect on the workmen's physical condition and capacity for work. In stagnant air at the temperature of 25° (wet bulb), an appreciable illness is experienced, which passes off at once when the ventilating current reaches a velocity of 3.3 ft. per second. In still air at a temperature of 30° (wet bulb) marked illness is felt, but conditions become supportable when the velocity of the ventilating current reaches 6.6 ft. per second.

From these data it is evident that attention to ventilation in mines is an important factor in determining the labor efficiency of the underground workmen, especially in warm moist workings. Dr. Langlois found that a workman could do more work in a temperature below 25° (wet bulb) when the velocity of the ventilating current is maintained at 2 to 16.5 ft. per second.

Plan for Maintaining Efficiency of School Heating Apparatus

A plan to set aside a "wear and tear" fund for the renewal or remodeling of heating apparatus in school buildings is proposed by Charles F. Eveleth, engineer in charge, Schoolhouse Commission of Boston. Mr. Eveleth's recommendations are contained in the newly-issued annual report of the Boston Schoolhouse Department. In his report he mentions specific instances where the replacement of worn-out apparatus in two school buildings was passed over on account of lack of money.

This situation, he says, is becoming more serious each year. Unless some means is taken to secure a large appropriation for this purpose, so that the department can keep pace with the necessary renewals, it will shortly be brought face to face with the problem of immediate renewals and no available money. To repair a worn-out boiler in mid-winter, he points out, is not only a very expensive matter, but means the closing of the building until the work is completed and even then is merely a make-shift to tide over the cold weather. There is no economy in attempting to repack old-fashioned indirect radiators during the summer vacation, when it is extremely likely that they will leak two or three years later.

The only successful solution of the problem, in the opinion of Mr. Eveleth, is to set aside each year an amount of money sufficient to take care of the inevitable wear and tear. This means not only the replacement of the boilers, but also a gradual remodeling of the older system, so as to bring them up to the present standards.

There are a large number of buildings in Boston, for instance, some of them heated by furnaces and others by either direct, indirect or the older form of gravity indirect steam apparatus, which can be kept up to temperature in

zero weather only by forcing. When it becomes necessary to supply the ventilation of the present-day requirements by frequently flushing out the rooms with outside air, the apparatus cannot fulfil the conditions imposed upon it, to the discomfort of the pupils and teachers. Insufficient radiating and boiler surface, small piping, often buried underground and partially choked with scale and sediment, and wood vent ducts, restricted in area and discharging frequently into an attic space, cannot be expected to produce satisfactory results.

Only the lack of money prevents the Boston Schoolhouse Department putting into execution a plan which has been carefully prepared for systematically renewing each summer the systems in several of the schools. This arrangement carried on for a series of years would eventually put all of the apparatus in satisfactory condition.

At the close of his report Mr. Eveleth refers to a tentative project that has been prepared for a central heating plant to supply a number of Boston's school buildings which are now separately heated. It is proposed to make use of water tube boilers of ample capacity. With such a building nearly at the centre of distribution, the expense of laying steam mains to supply the various buildings would be a minimum one. The plan calls for the complete remodeling of the apparatus in two schools, substituting a plenum system of heating and ventilation in place of the present furnaces.

The report states that for a large part of the school year the demand for steam to supply the heating apparatus would be in excess of that required to operate engines for furnishing electric current for power and for lighting the entire group of buildings. With a market for exhaust steam the cost of producing electricity would be brought to the minimum. The building as proposed is of sufficient size to contain direct connected units without further extensions.

The following are some of the more important advantages of this plan:

1. Freedom from fire arising either from overheated boilers or spontaneous combustion of coal.

2. With the removal of the old type of heating apparatus and the installation of a modern system of air washing and humidification, the air supplied to the class-rooms would be thoroughly cleaned and purified, and in addition there would be an excellent opportunity afforded for a very thorough study of the benefits which it is claimed can be derived by humidification. There is no section of Boston where there is greater need for pure air than in this district.

3. Freedom from dust, soot and dirt in the buildings through the burning of coal and the removal of ashes.

4. It will be possible to produce steam with greater economy in a centralized plant rather than in several smaller plants.

5. With the responsibility for the heating apparatus of all the buildings centered in one person, there will be a more systematic effort to keep the temperature and air conditions in the various buildings at the proper point.

6. With the removal of the boilers and coal storage rooms from the basements of the schools there will be more space available for other uses.

Statistics of School Building Construction

An interesting table giving the construction statistics for 30 school buildings in Boston, erected since 1902, is contained in the report of the Schoolhouse Department of Boston for the year ending February 1, 1911. The table gives the cost of the buildings, the cubic contents and the number of pupils. An average has been compiled of the 30 sets of figures with the following results: The average cost of construction per cubic foot of space is 22.8 cents. The cost of the building contracts averages 83.7% of the total cost of the building with a range of 77% to 86%. The cost of the heating contracts averages 9.5% of the total cost of the building with limits of 7 and 15%. The cost of the plumbing contracts averages 4.6% and that of the electrical contracts 3.4% of the total cost of the building. Three of the 30 buildings are high school buildings and the average cost of building of the remaining 27 schools is per pupil, $178. The cost per pupil of the three high school buildings is $548.25, $940.65 and $495.19 and the cubic contents of these buildings are 1,267,608, 1,392,848 and 1,388,807 cu. ft., respectively; the number of pupils accommodated in these three buildings is 540, 350 and 600, respectively.

New Chicago Contractors' Association

A new contractors' association has been formed in Chicago known as the Building Construction Employers' Association. This body has been organized to succeed the Chicago Building Contractors' Council. In addition to the usual objects sought by such an organization the new body of contractors proposes, when one trade calls a strike, to lock out every workman in that trade, regardless of where he is employed in the city. When one or more trades go on sympathetic strike on any particular building, those trades are to be locked out on all buildings.

Annual Convention of National Association of Sheet Metal Contractors

Important actions taken by the National Sheet Metal Contractors' Association, at its recent convention in Omaha, Neb., included the adoption of the Federal Furnace League plan for rating warm-air furnaces on the heat unit basis instead of the cubic feet basis. Following the reading of a report to this effect by W. R. Taylor, chairman of the committee on warm-air furnaces, the following resolution, which was attached to the report, was unanimously adopted:

Whereas: we believe the present method of rating furnaces to be inaccurate and unreliable, and that furnaces should be tested and rated according to an adopted standard method; and

Whereas: there is in existence no standard, accurate rule for computing the heat requirements of a building, nor for the guidance of furnace dealers in the planning and installation of warm-air heating plants; and

Whereas: the Federal Furnace League, which is the only national organization of furnace manufacturers doing anything for the benefit of the dealer and for the perpetuity and upbuilding of the warm-air furnace business, and through it the only hope furnace dealers have of remedying the present existing deplorable conditions, and is now preparing, in consultation with the furnace committee of the National Association of Sheet Metal Contractors, a textbook embodying a set of standard authoritative rules for the guidance of dealers in the installation of furnaces, and is also testing and rating the furnaces of its members and assigning correct guaranteed capacity ratings to said furnaces; and

Whereas: we believe it is strongly to the interest of our members in the furnace business that furnaces be accurately tested and rated under a standard, uniform method, and that said members be furnished with authoritative rules for the installation of furnaces; Therefore, be it

Resolved, That the National Association of Sheet Metal Contractors approve this work the Federal Furnace League is doing, and request its members who purchase furnaces from manufacturers who are not members of the league to write or take up this subject with said manufacturers and request them to join the said league, that we may, through said manufacturers, enjoy the benefits and advantages to be derived therefrom.

The association reaffirmed its stand for the open shop and for no restriction of apprenticeship by voting down a resolution in favor of eliminating these principles.

St. Louis was chosen for the 1912 convention which will be held during the second week in June.

The following officers were elected for the ensuing year:

President, John H. Hussie, Omaha, Neb.; first vice-president, H. B. McGrath, Cleveland, O.; second vice-president, John Bogenberger, Milwaukee; third vice-president, Julius Gerrock, St. Louis; fourth vice-president, F. J. Hoersting, Dayton, O.; treasurer, W. A. Fingles, Baltimore; secretary, Edwin L. Seabrook, Philadelphia; trustees, H. W. Michael, Denver; T. P. Walsh, San Antonio; Walter Wimmer, St. Louis.

First Annual Meeting of Institute of Operating Engineers

A programme of ambitious scope marked the first annual meeting of the Institute of Operating Engineers, which was held in the Engineering Societies Building, New York, September 1-3, last. A portion of two sessions was devoted to the reading of technical papers, the subjects including "Temperature Changes and Heat Transmission," by Vernon L. Rupp, Chief Engineer Williamson Trade School; "A Boiler Room Analysis of Coal," by J. P. Fleming, Chairman J. T. Waters Branch; "Cooling Towers vs. Steam Pumps," by Henry W. Geare, Chief Engineer Peter Doelger's Brewery.

At another session a paper was read by James A. Pratt, director of the Williamson Trade School, on "A Method of Teaching Operating Engineering."

The branch of the institute located in Chicago is known as the T. J. Waters Branch No. 1, District No. 5, being named after the late Thomas J. Waters, engineer for the Chicago Board of Education.

A New Book for Ventilating Engineers

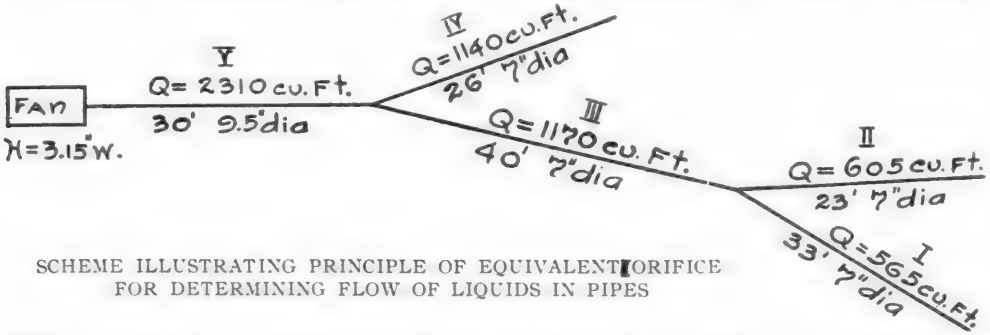
Under the heading, "Flow in Pipes," written in German by V. Blaess, D. Eng., the author takes up a thorough investigation of flow of liquids in pipes, particularly that of air of ordinary atmospheric conditions under low pressure, as applied to ventilation.

As a basis for his investigations the author introduces a new form of what is known as "equivalent orifice," his equivalent orifice being an ideal one, which would discharge, without forming "vena contracta," exactly the same quantity of, say, air as does a pipe of given length.

There exists an "equivalent orifice" for each of the three elements of resistance to flow in pipe; first, when friction only is taken in consideration; second, considering elbows only (these being taken as equivalent to a certain number of feet of straight pipe), and, third, considering the resistance due to "vena contracta" (entrance to the pipe, end of it and, generally speaking, any changes of the pipe shape. However

complicated the piping or duct system may be, it always can be subdivided into these three elements as to resistance, and equivalent orifices can be found correspondingly. Using a very simple way of "geometrical" addition similar to that which, in mechanics, is known as parallelogram of forces, the author figures out a resulting equivalent orifice for the whole piping, which would discharge exactly the same quantity of air as the piping itself does.

However simple this way of figuring the resulting equivalent orifice is, still it requires considerable time and in order to save this, the author uses, as a help, graphical methods in a separate volume of diagrams, which enable him, at the least expenditure of time, to find the final equivalent orifice for any piping or duct system.



SCHEME ILLUSTRATING PRINCIPLE OF EQUIVALENT ORIFICE FOR DETERMINING FLOW OF LIQUIDS IN PIPES

The author derives the following extremely simple formula:

$$A = \frac{Q}{C\sqrt{H}}$$

A = equivalent orifice in square feet.
Q = quantity of air discharged in cubic feet per minute.
C = constant.
H = total pressure in inches of water necessary to push Q cubic feet through pipes.

Quantity of air is usually fixed beforehand; equivalent orifice can easily be found from the volume of diagrams. Q and A being thus known, H can be figured out from the formula. If a fan is attached to the piping, H will represent the total pressure to be produced by the fan; with both H and Q given, it is a simple thing to select the fan. This procedure can particularly be applied to multivane type of fans, which, it is known, can be properly selected only when the pressure and capacity are known.

The conception of equivalent orifice greatly helps in understanding a good many intricate events of flow in pipes, which, at first glance, would seem to be paradoxical, if not impossible. The following example may serve as a striking illustration of what has been said. A piping, represented by the scheme above, was several times tested by the author in the most careful way and also figured on the basis of equivalent orifice. Final results are marked on the corresponding branches in the scheme. The reader will kindly notice that the branch III, though being considerably longer than the branch IV, carries more air than the latter. At first glance it would seem vice versa.

Investigating a piping under suction, the author pays considerable attention to what is known as injector-like action of the streams of air with high velocity upon those with low velocity. Under certain conditions, he states, the velocity in some branches may become considerably higher than in the main duct behind those branches; the stream, having higher velocity, acts like an injector upon that of lower velocity, thus acting in a way of increasing the suction in that part of the main duct. This increase of suction is sometimes as high as 20% more than the suction measured immediately at the entrance into the fan.

The last two chapters of the book are devoted to the theory of fans and measurements of pressure and velocity in ducts in accordance with the newest scientific methods.

The book is apparently written by a man of practice, by the way it treats the different problems which a ventilating engineer encounters in his every-day practice, and no doubt would prove of great interest and value to anybody who is desirous of working himself as deeply into problems of transporting air by means of fans and ducts as modern science permits.

The book, which, as stated, is in German, has only recently appeared and can be had from the publisher, R. Oldenbourg, Munich and Berlin, Germany.

Building for Profit, embracing principles governing the economic improvement of real estate, which was recently published, has already reached its second edition. This work is from the pen of Reginald Pelham Bolton, who is president of The American Society of Heating and Ventilating Engineers. The subject matter has special interest for the architect, the engineer and the public

generally, as it presents much new material relating to the subjects of increase and depreciation in values of land and buildings, the bearing of taxation on values and rentals, the relative costs and values of buildings and land, the difficulty of limitation of heights of buildings, the costs of operation compared with rentals in office, loft and apartment buildings, and detailed methods and facts relating to depreciation of machinery. The book is liberally illustrated with diagrams, tabulations and photographic views. Published by the De Vinne Press, New York. Pp. 124. Size 8x11 in. Price, $2.00.

Current Heating and Ventilating Literature

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the articles mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

BLOWERS

Application of Gas Engines to the Driving of Blowers. Illustrates and describes an arrangement of internal-combustion engine coupled to turbine-type blower. 1200 w. Mech Engr—June 2, 1911. 40c.

HOT BLAST SYSTEMS

Some Problems in the Heating and Ventilating of Factory Buildings. Am Arch.—June 14, 1911. 4 figs. 1000 w. Describes hot-blast systems in two factories. 80c.

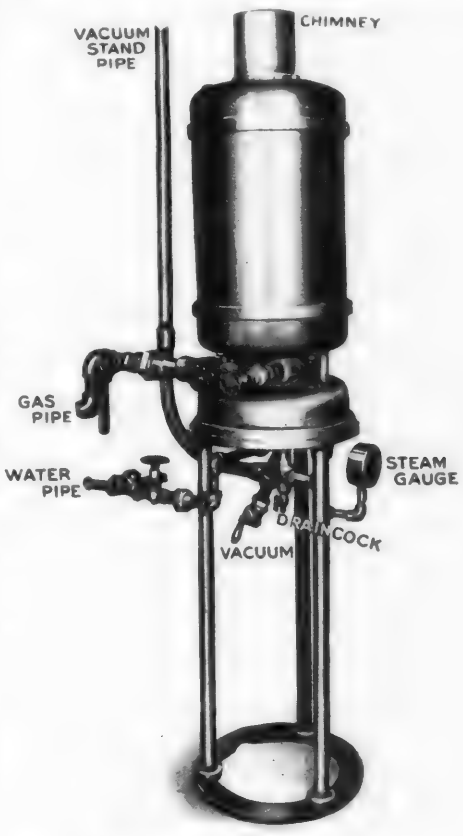
STEAM HEATING

Some Points Involving Mechanism and Advantages of Vacuum Steam Heating. J. W. Hook. El Rev & W Elecn.—June 17, 1911. 2900 w. 20c.

NEW DEVICES

The "Purifier" Vacuum Cleaner

A unique type of vacuum cleaner, built on the principle of the White steamer for automobiles, has recently been placed on the market by the Sanitary Vacuum Cleaning and Power Co., of Brooklyn, N. Y. It is a stationary cleaner installed in the cellar and operated by gas. It can be placed in any house piped for water and gas. This machine consists of a number of hollow cast-iron sections fastened together by an ingenious system of small riser tubes. Passing up between these sections are two pipes, one a water pipe connecting at the top with the uppermost section, the other a vacuum pipe, the open end of which is about an inch above the upper cross section. Connected with the lowest cross-section is a small ejector, which in turn connects with the vacuum pipe. At its lower end the vacuum pipe passes from the machine and connects with a standpipe, running from the upper floors of the house to the machine in the cellar. The water pipe passes out from the bottom of the machine to a connection with the house water pipes, the supply of water being regulated by a needle valve. Under the castings and forming the base of the machine is a cast-iron circular fire box into which the gas is admitted. In front of this, and separated from it by a short distance, is the pipe running from the house gas connections, with the necessary valves. The gas jumps across this opening, drawing air in with it, and ignites within the circular chamber, the flame passing up between and around the cross sections, the vacuum and water pipes and then out over the top section into the chimney. Surrounding the sections is a cover of asbestos,



THE PURIFIER VACUUM CLEANER, A STATIONARY MACHINE OPERATED BY GAS

and another of sheet-iron. The whole machine is 11 in. x 22 in. in size and weighs about 125 lbs.

In its operation the gas is first lighted and the machine allowed to get thoroughly hot. Then the needle valve on the water pipe is opened and the water admitted. It passes to the top of the

THE PURIFIER VACUUM CLEANER USED AS A POWER GENERATOR

machine, enters the upper section and begins to flow downward, circulating through the sections and forming into steam. This steam, in turn, becomes dry and highly superheated, and thence passes through the ejector into the vacuum pipe, being discharged upward into the chimney, an always open safety valve preventing the possibility of any explosion. The discharge of the steam in this manner draws all the air out of the vacuum standpipe, creating a vacuum as high as 15 or 17 in., depending on the steam and water pressure; but this vacuum can be lowered to 8 or 10 in. and a greater volume of displacement provided, if desired. The discharge of steam being steady, the exhaust of air from the vacuum pipe is also steady and a strong continuous suction is created, which gives a high cleaning power to the machine. The dirt taken up by the cleaning tools passes through the heated part of the tube in the machine, through the superheated steam and at the top through the burning gas. Everything which will burn is consumed and the non-consumable material (such as grains of sand, etc.) is discharged through the chimney.

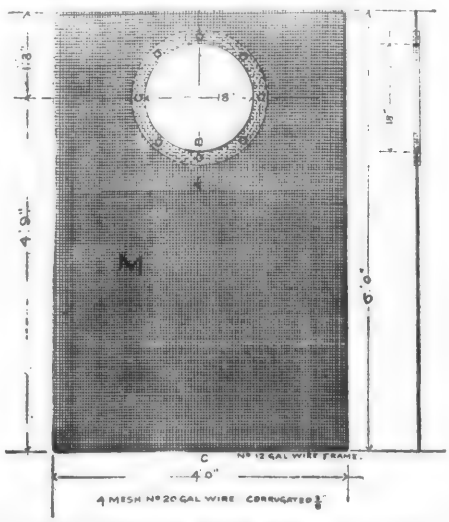
In its operation this machine consumes about 100 cu. ft. of gas per hour. It is not intended, however, merely for a vacuum cleaner, as it can be used as a power machine also, operating a small motor, and at the same time creating and maintaining a vacuum of from 5 to 8 in. The company, at its demonstrating rooms in Brooklyn has a ½ H. P. engine, run by one of its machines, which is also creating 7 in. of vacuum at the same time. It can be applied also to heating purposes. Owing to the fact that the water and steam pressures automatically regulate each other, thus insuring safety, and the further fact that it is practically as simple to operate as the gas range, its use requires neither license nor the employment of skilled mechanics.

The Krause Dust Collector and Filter

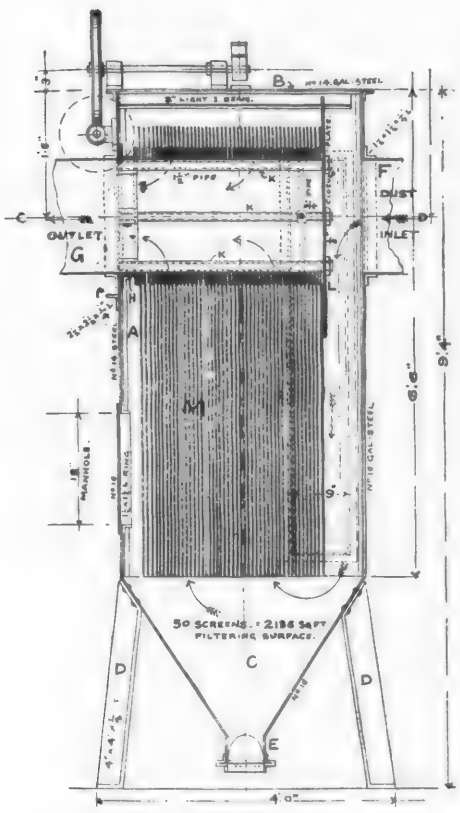
The accompanying illustrations show the construction of a new type of dust collector, or air filter, designed especially for removing finely suspended dust resulting from the manufacture of refined sugar, coffee, spices, drugs, chemicals, etc.

It may also be used for the filtration of flue and other gases containing valuable by-products, as well as for the purification of air in public and private buildings for the purposes of ventilation, heating, cooling, etc. The patentee of the device is A. E. Krause, 345 Fairmount avenue, Jersey City, N. J.

The filter is notable for having an unusually large amount of effective filtering surface attainable, also for the ease with which the filtering surfaces may be cleaned and automatically kept in effective and proper condition.



ARRANGEMENT OF WIRE SCREEN, KRAUSE DUST COLLECTOR

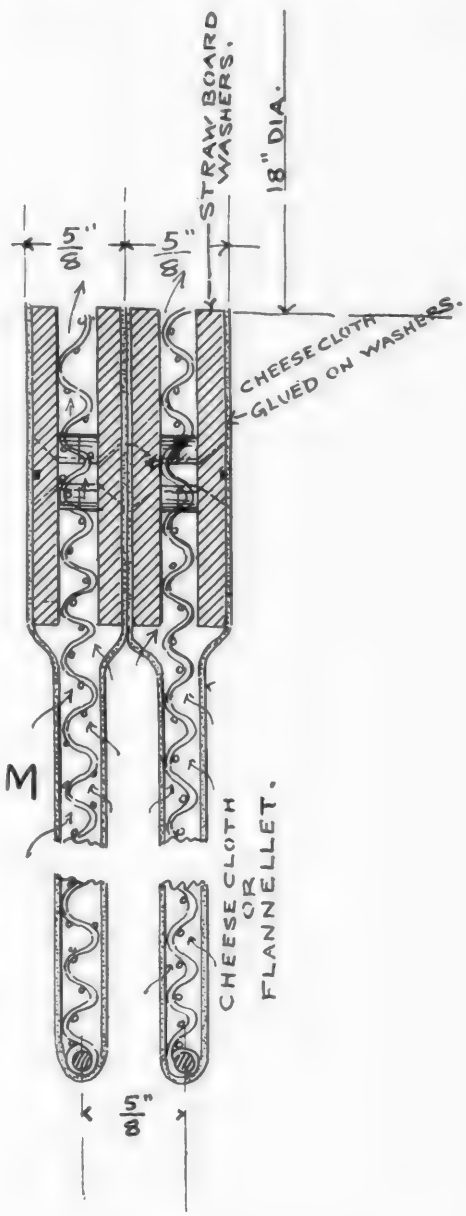


CROSS SECTION THROUGH SCREENS, KRAUSE DUST COLLECTOR

The air passing through the filter may either be forced by means of a pressure blower connected to the inlet F, or it may be drawn through by means of a suction fan connected to the outlet G. The dust collector shown in the illustrations contains 50 filtering screens which are made of four-mesh No. 20 galvanized wire, corrugated with ⅜-in. corrugations and framed all around with No. 12 galvanized wire, sleeve jointed, the meshes of the wire being bent around the frame as shown in the detail. Covering the entire body of each screen is a layer of cheesecloth, flannelette or other suitable air or gas-filtering fabric, sewed close to the edges of the screen and glued fast to the collars.

Each screen is 4 ft. x 6 ft. and contains 42.72 sq. ft. of effective filtering surface, thus making for the entire 50 screens a total filtering surface of 2136 sq. ft. within a floor space of 3 ft. 4 in. x 5 ft.

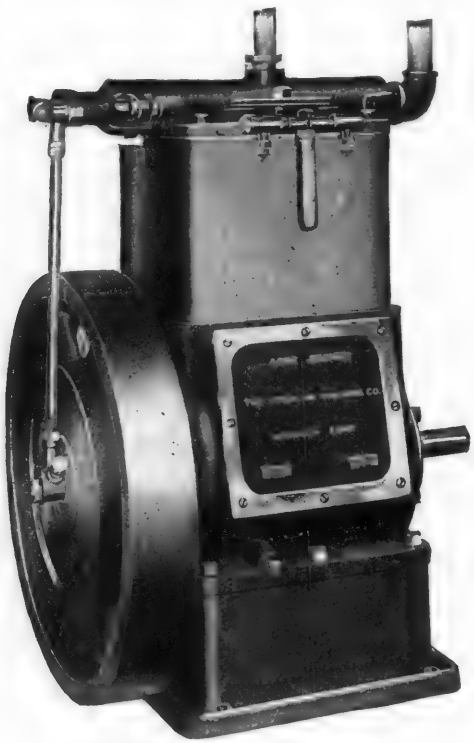
In order to keep the filtering surfaces up to their full efficiency, a vibrating, or knocking arrangement is provided on top of the apparatus, as shown, actuated by a worm gear, which is regulated to give a knock at regular intervals so as to shake the dust from the filtering surfaces and to permit it to fall below into the hopper C, from whence it may be removed from time to time through the outlet E.



FULL SIZE SECTION AT A-B AND C THROUGH WASHERS AND SCREENS, KRAUSE DUST COLLECTOR

An Improved Type of Small Steam Engine

With the rapid growth and popularity of the gas engine the impression has become quite general that the small steam engine is no longer an important factor in engineering fields.

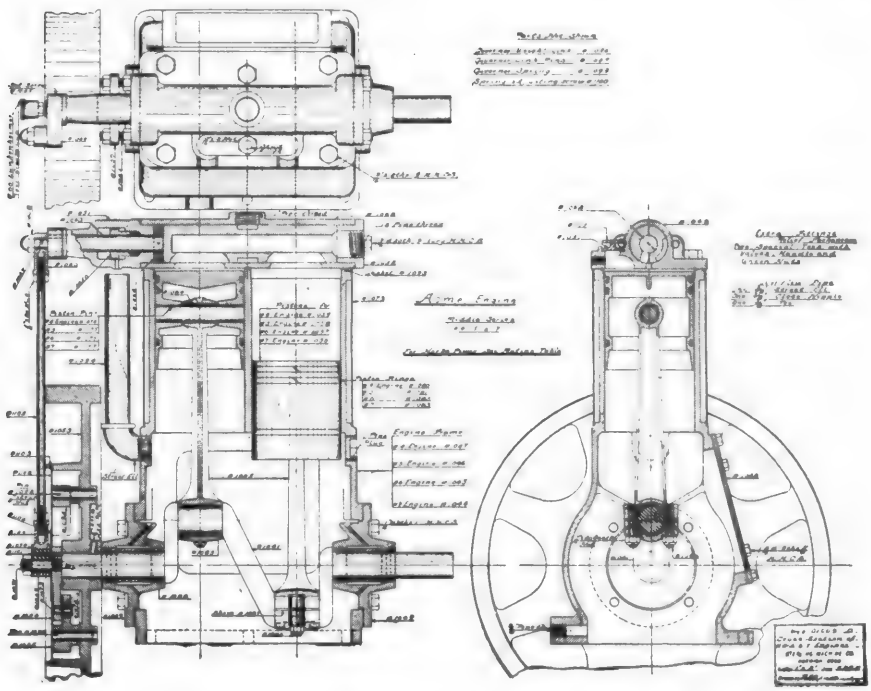


THE ACME STEAM ENGINE

This impression is hardly justified, according to the experience of one of the large manufacturers of small steam engines in this country. This firm states that the mechanical stoker and similar advances in steam engineering have made the small steam engine indispensable and more essential than before. This is said to be particularly true in plants where steam is a source of power, for in such plants the small steam engine proves an auxiliary which is very hard to equal both from the standpoint of economy and efficiency.

The Acme engine, formerly manufactured by the Rochester Machine Tool Works, Rochester, N. Y., and now by the Sterling Machine Co., Norwich, Conn., is a well-known type, having been manufactured for the past twenty years and improved from time to time to meet the demands of the day for a rugged, simple and economical unit.

The manufacturers have recently added some interesting features to this engine, which is of the vertical, 2-cylinder, single-acting enclosed type, with a balanced rocking valve and are splash lubricated. The engines are built in three series of sizes, the small series being 2⅛ in., 3 in., 3 5-16 in. and 3½ in.

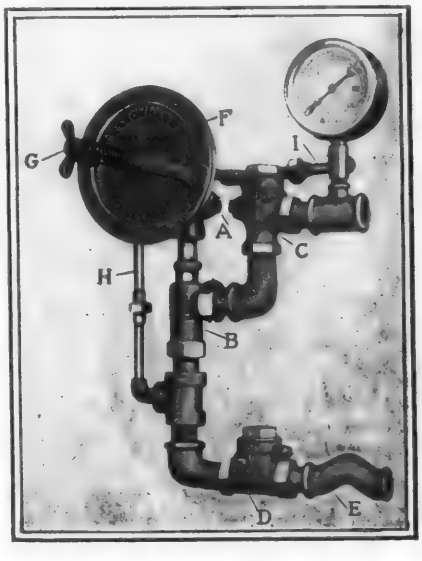


CROSS-SECTION VIEW OF THE ACME ENGINE

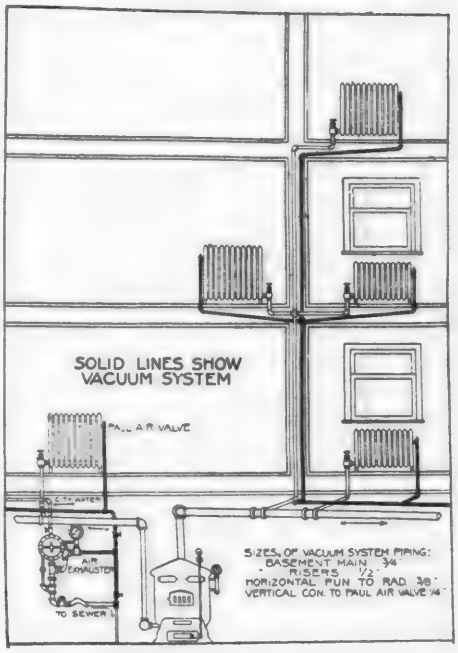
stroke. These small engines are identical in external appearance. The middle series is 3 5-16 in., 4 in., 4 9-16 in., 5 in. x 5 in. stroke These four sizes are also identical in external appearance and practically of the same weight. The large series of three engines is 5 in., 6 in. and 7 in. x 7 in. being also of the same external size and general appearance. This range of sizes covers all the applications to which these engines are especially adapted. Because of the simplicity of construction, the type of valve which adjusts itself to wear, the large bearing surfaces which are well lubricated at all times by a splash of oil, they are especially well suited for direct connection to small gear driven pumps, any variety of belt or direct-driven pumping machinery for contractors or irrigation purposes and for small plants such as laundries, creameries, etc., and they have been adapted in a number of instances to marine service such as lighting, driving ammonia compressors, ventilating fans, etc.

A New Vacuum Heating System Air Exhauster

A unique device for creating and automatically maintaining a vacuum on a steam-heating system is known as the Leonhard automatic water-driven air exhauster. It is made and sold by Frederick Leonhard, 536 East 123d street, Cleveland, O. The device is designed for use in connection with Paul automatic air valves on the radiators, the operation being similar to that of the Paul vacuum system. The Leonhard air exhauster is made entirely of metal, with copper and bronze diaphragms, the central movement of which is 1/32 in.



LEONHARD AUTOMATIC WATER-DRIVEN AIR EXHAUSTER



TYPICAL INSTALLATION OF GRAVITY RETURN STEAM HEATING PLANT, WITH LEONHARD VACUUM SYSTEM

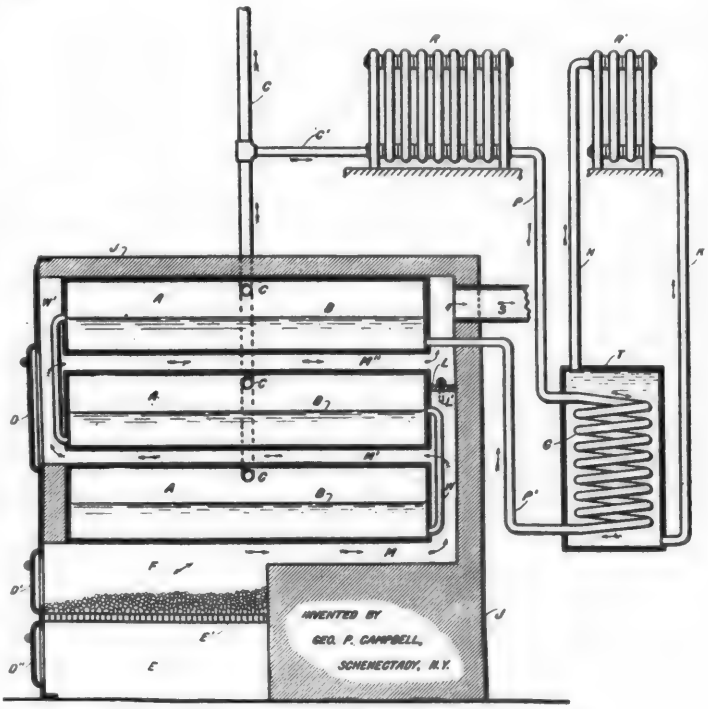
City water is used to operate the device. The water pressure enters at A and raises a differential plunger within the plunger casing or cylinder, allowing full water pressure to pass through a 1/8-in. orifice or jet in ejector B, thus drawing the air out of the air lines through check valve C and discharging air and water to the sewer through check valve D and seal E. Opposite the inlet A to the plunger casing or cylinder is a nipple to which screws the diaphragm bowl F. Through the center of diaphragm bowl F passes spindle G, which seats directly on a very small by-pass or relief port near the top of plunger cylinder. The spring on diaphragm spindle G keeps the spindle away from the seat 1/32 in., allowing the water that seeps past the plunger to by-pass through the 1/8-in. pipe H, and thus prevent pressure from forming on top of the differential plunger. Between the spindle G are locked two metal diaphragms, one at the top of diaphragm bowl and one at the bottom, thus forming a vacuum chamber from which the air is drawn through 1/8-in. pipe I. Therefore, if the spring or diaphragm spindle G is set so that 4 in. of vacuum will draw the diaphragm in (dish it) 1/32 in., the spindle G will seat on the by-pass port, permitting pressure to form on top of the differential plunger, which suddenly brings the plunger down on its seat, shutting off the

water from the ejector suddenly. On the other hand, when the vacuum falls to 3 in., the spring draws the spindle G from the by-pass port, relieving the pressure from the top of the cylinder and permitting the plunger to raise suddenly and open full the water passage to ejector B.

For creating a vacuum where high pressure steam is available, a steam-driven air exhauster is furnished.

The Wonder Boiler

A new type of boiler, the invention of George P. Campbell, 740 Brandywine avenue, Schenectady, N. Y., is notable for having three water lines, three steaming surfaces and three steam domes. The inventor advises us that he has a boiler of this type in use in his own residence, a two-flat house, which heats both flats. It is made of steel set up in brick. A record made of its operation on February 16, 1911, showed that with the outside temperature 5° F. below zero, the temperature at 6.30 a. m. in the second or upper flat was 73°, the heater having had no coal since 10 o'clock the night before. This was without the aid of the kitchen range. At the same time the temperature in the smoke pipe was 148°. By reference to the illustration, it will be noted that the pipe line C connects all three boilers together and makes a steam passage to radiator R. After steam is condensed in radiator R, it passes to the coil G, then to the upper boiler where it is reheated. Then it flows through pipe W^1 to the middle boiler and finally to the bottom boiler through pipe W. The hot gases and the water pass through the boiler in opposite directions, thus bringing the coldest water in contact with the cooler gases. The radiator R is a hot-water system attached to the water line P to remove the heat from the condensed steam before it returns to the boiler. L is a damper for use in the event that increased draft is required, as it makes a direct connection with the smoke pipe.



SECTIONAL VIEW OF THE WONDER BOILER

Lagonda Automatic Cut-Off Valve, made by the Lagonda Mfg. Co., Springfield, O., is the only valve which has been admitted, up-to-date, to the Museum of Safety Devices, which is maintained in the Engineering Societies Building, 39 West 39th street, New York. The valve, as described in recently-issued circular matter, is so made as to close automatically if a break occurs on either side of the valve. The circular describes some tests made at Washington in January, 1909, in which a 4-in. valve was used, showing the reliability of the mechanism.

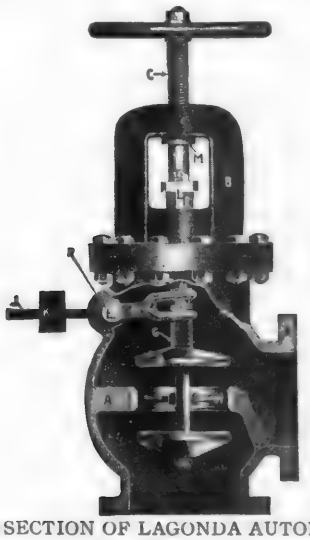
The tests were arranged for the Board of Supervising Engineers of the Department of Commerce. The accompanying diagram shows the arrangement for the tests and it was possible to duplicate at the trial any circumstances which the valve might be called upon to meet. For instance, by closing the quick opening valve D and then opening it quickly the same condition was obtained as would result from a break in the steam line between the valve and the engine. By closing and opening the quick opening valve E it was possible to duplicate the various circumstances which would be liable to arise due to a break between the valve and the boiler, such as the blowing out of a boiler tube or bursting of a mud-drum.

The following gives the results of some of these tests. Various trials were made representing breaks in boiler tubes, and in every instance the valve

closed promptly, even when the outlet for the escaping steam was only equivalent to a 1 5-16-in. opening.

To test the action of the valve in case of a break in the header, the quick opening valve was opened in two seconds, the amount of the opening being equivalent to an outlet of 1½ in. in diameter. Steam pressure was only reduced from 180 to 140 lbs., but the rush of steam through the valve caused it to close instantly.

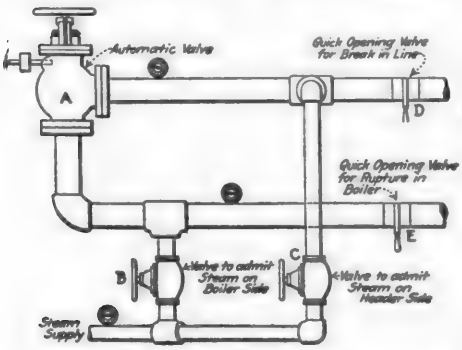
A somewhat similar test was made in which the outlet was equivalent to a



CROSS SECTION OF LAGONDA AUTOMATIC CUT-OFF ANGLE VALVE

1¾-in. opening. In this case the valve opened in three seconds, and the pressure dropped from 180 to 120 lbs., at which point the valve closed immediately. These tests show that the valve will operate even if a steam main should only split for a short distance.

The following test was then made to



ARRANGEMENT OF PIPING IN TESTS OF LAGONDA VALVES

see how the valve would act where a sudden or unusual supply of steam is required, as is often the case in electric light and power plants and rolling mills. The first test was with 1½-in. opening. The quick opening valve was opened slowly, covering a period of thirty seconds. The steam pressure dropped from 180 to 90 lbs., but the automatic valve remained open.

In another test, similar to the above, only eight seconds were used in opening the quick opening valve. Steam pressure again dropped from 180 to 90 lbs., and the valve remaining open.

In the third series of tests only 5 seconds were consumed in opening the quick-opening valve, the automatic valve in each instance remaining open. After each test in this series, the quick-opening valve was opened at one movement and the automatic valve went promptly to its seat. These showed that the valve would take care of any unusual but legitimate demand for steam, and would also promptly close under sudden rush of steam, such as would occur in the case of a rupture in the main.

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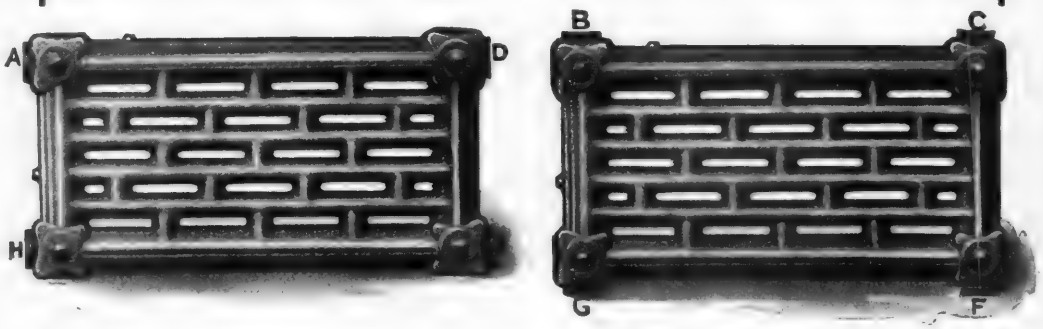
Out Of The Way Radiators



¶ There is an ever-increasing demand for radiators that can be hung off the floor on wall or ceiling, placed in skylights, and still be practical, efficient heating surfaces.

¶ No radiator made adapts itself better to space-saving conditions than the ATHENIAN WALL PATTERN of United States Radiators. Used in factory buildings where space is most valuable, in churches and schools, under windows to stop cold air currents, in assembly halls, stores, garages and all buildings where radiation should be off the floor.

¶ The ATHENIAN WALL PATTERN is a most efficient wall radiator. Made in three sizes, connected with extra heavy right and left hand inside nipples. Has cross-bar circulation which increases its heating value, giving more efficiency than can be had in any other pattern of wall radiator.

¶ Assembled in all shapes at the factory which saves labor cost on the job and they can easily be used in odd corners and out of the way places where regular radiation would be impossible.

¶ It seems to us that you must be interested in this modern space-saving radiator, and we have prepared for your benefit a booklet that illustrates and describes in full the special advantages of this OUT OF THE WAY RADIATOR. It's free—Write for it to-day.

UNITED STATES RADIATOR CORPORATION

GENERAL OFFICES. DETROIT, MICH.

BRANCHES IN PRINCIPAL CITIES

Makers of More Styles of Radiation Than Any Other Individual Manufacturer

TRADE AND MISCELLANEOUS NOTES

Deaths

C. M. Kemp, president and founder of the C. M. Kemp Mfg. Co., manufacturers of pipe threading machinery, Baltimore, Md., died at his home in that city, July 24. Mr. Kemp was 59 years old. He once ran for mayor of Baltimore on the silver Democratic ticket, having been a warm supporter of William J. Bryan and the principles he advocated. Mr. Kemp was notably generous to his employees and had adopted many of the modern co-operative principles in his business.

George Lane, one of the founders of the present firm of Mayor-Lane Co., dealers in heating and plumbing supplies, died at Westchester, N. Y., at the age of 71 years. He retired from business several years ago.

Miscellaneous Notes

Prof. John R. Allen, of the Department of Mechanical Engineering, University of Michigan, Ann Arbor, Mich, sailed for Constantinople, Turkey, July 29, to complete the equipment of the Engineering Building of Roberts College at that point. Prof. Allen, it will be recalled, spent some time in Constantinople about a year ago, having been engaged to design the equipment for this department of the institution.

Lebanon, Ind.—The Lebanon Heating Co., organized two years ago with a capital stock of $75,000, will be sold to a new company which will assume the present company's debts, amounting to $75,000. As this is the only consideration in connection with the purchase the former stockholders will lose the amount of their holdings.

Philadelphia, Pa.—A company is being formed to supply Trappe with electricity for heat and power.

Compulsory ventilation of London tenements is provided in a new by-law proposed by the Paddington Borough Council, one of the metropolitan bor-

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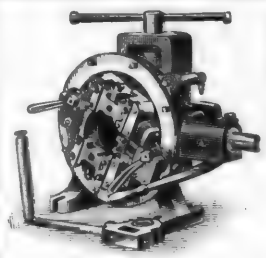

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From 1 Inch to 4 Inches

TO BE USED FOR EITHER HAND OR POWER

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NEW YORK CHICAGO

oughs. It reads as follows: "It shall be compulsory for all windows of sleeping apartments to be opened wide for at least two hours a day, and for floors to be swept once a day and washed once a week." It is proposed to appoint inspectors with right of entry into the houses to see that the regulations are observed. The maximum penalty for breach of these laws will be $25, and $10 for each day the offense is continued.

Terminal Freezing and Heating Co., Baltimore, Md., capital $1,600,000, half preferred and half common stock, has been organized by the leading directors and stockholders of the Baltimore Refrigerating and Heating Co., to take over the business of that concern, which has been for some time in the hands of a receiver. Among the incorporators are Francis T. Homer, E. Clay Timanus, Marshall Winchester and Michael Schloss. These, with Horace P. Serrill and Harry F. Ambler of Philadelphia, and Robert H. McNeall of Washington, D. C., will constitute the board of directors for the new concern.

Chicago, Ill.—T. B. Dean, of Chicago, has been awarded a 25-year franchise by the Board of Public Works of Gary, Ind., for the erection of a central steam heating plant in Gary and the right to lay pipe lines along the principal streets. The heating plant will be built at once and the power plant will cost $30,000. According to the terms of the franchise the city will have the privilege at the end of 25 years of buying the plant and no value is to be placed on the franchise at that time. It is also provided that flat rates of not to exceed 35c. per square foot of direct radiating surface exposed for the season shall be charged. There will also be a meter rate of 60c. per 1,000 lbs. of condensation. Another meter rate will provide for a discount of 10% when paid in advance. The city buildings are to be given a rate 25% less than the commercial rates.

Modern Science Club, 125 South Elliott place, Brooklyn, N. Y., announces that, in addition to the regular Tuesday night lectures, the club's proposed educational programme for the season of 1911-1912 will consist of two courses of 30 lectures, each on subjects bearing directly on the vocation of steam engine operation. The first course will commence October 6 and will embrace mathematics for engineers, including the slide rule, natural philosophy and graphical statics. The second course will commence October 9 and will consist of lectures on fuels, their origin, nature, characteristics and analysis; steam, its generation and distribution in engines, pumps and turbines, theory and practice in the use of condensers, including their design and installation; steam engine design and operation; theory of the turbine, both impulse and reaction; the indicator and its application; the slide valve diagram and its value in steam engine design; internal combustion engines, including gas producers; flue gas analysis and general engine and boiler-room chemistry. The club will open its season September 26 with a beefsteak dinner and reception to the national and state officers of the National Association of Stationary Engineers. A unique method has been adopted for making the

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By using Dixon's Pipe-Joint Compound on joints. No damage to tools or fittings then when you want to open joints.

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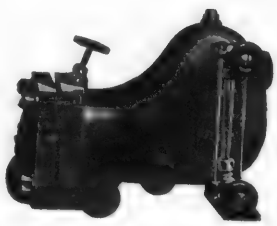

When you need a Steam Trap buy one you know will work. With a McDANIEL we take all the chances. Don't pay until you are satisfied. We have been 25 years manufacturing Steam Traps and know there is no better trap made. May we send you one for trial?

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club's announcements. Two calendars are sent to each member, one for the office and one for the home. Inserts are to be sent monthly giving the club announcements in detail, with a calendar for the month, having the club dates in red.

Dravo-Doyle Co., Pittsburg, Pa., which has had an experience covering a period of 20 years in the construction and operation of power plants, announces that it has added a steam specialty department to its business in charge of J. C. McAllister, Jr. This department is prepared to offer reliable steam specialties, such as steam traps, back pressure valves, pressure-reducing valves for all services, etc. The company maintains branch offices at Cleveland, Chicago, Philadelphia and Huntington, W. Va.

Manufacturers' Notes

Pullman Ventilator Co.'s plant at York, Pa., has been sold to a syndicate, of which one of the principal members is Freeman Allen, Rochester, N. Y. It is reported that a new corporation will be formed with a capitalization of $300,000, which will absorb possibly three other manufacturers of automatic ventilators.

American Radiator Co., Chicago, Ill., has let the contracts for the construction of its new building at Bayonne, N. J. The building will be two stories high, and will occupy a lot 280 x 287 feet. It will cost about $200,000. The company is also building a $25,000 brick foundry building at its Piece plant in Buffalo, N. Y.

Robertshaw Mfg. Co., Pittsburg, Pa., has taken over the business of the House Service Utilities Mfg. Co., of Pittsburg. The company will manufacture the Robertshaw Thermo valve and the other specialties heretofore made by the House Service Utilities Co. New quarters have been secured at 101-103 Water St.

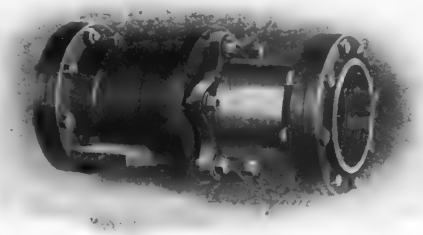
McDonald Bros. Co., Cleveland, O., announces that it has moved to new quarters in the Swetland Building, on Euclid avenue.

H. Mueller Mfg. Co., Decatur, Ill., manufacturer of heating, water, plumbing and gas brass goods, is arranging to establish a manufacturing plant in Canada to supply its large and rapidly growing Canadian trade. The site for the new plant has not yet been decided. The company intends to make its Canadian plant a permanent one and Adolph, Philip and Oscar Mueller, who have recently been in Canada, have expressed themselves as deeply impressed with the marvelous business, manufacturing and agricultural possibilities of the country. At present from 60 to 70 of the Mueller's company's 900 employees are kept busy on goods for the Canadian trade and

Jenkins Automatic Air Valves

for the removal of air from steam radiators, heating coils, etc. Thousands in use and giving entire satisfaction. They are inexpensive, neat in design, and take up no more room than an ordinary air cock. Besides being very simple, they are most sensitive and durable.

JENKINS BROS , New York, Boston, Philadelphia, Chicago



High Grade Expansion Joints

We manufacture expansion joints for inside, outside and underground work. In all sizes from 1 to 30". Our experience covers a period of over thirty years. Let us figure on your requirements.

Write for Bulletin 104

American District Steam Co.

Lockport, N. Y. **Chicago, Ill.**

the new plant will start with at least that number of hands. The company has catered to the Canadian trade under the handicap of a 30% customs duty. A warm welcome awaits the company in Canada, where the advantages of various locations have been vigorously urged by the local interests.

Trade Literature

Modulation System of Steam Heating in an Office Building, Also Results of a Test is an illustrated description of the heating plant installed in the Haynes Building, Boston, Mass., published by Warren Webster & Co., Camden, N. J. The plant is described in detail from an engineering standpoint, the views including the heating layout for the basement and first and second floors of the building, in addition to those showing the application of the Webster Modulation system.

In the same pamphlet is published a test of a Modulation heating system made in an office and warehouse building in Montreal. Size 6x9 in. (standard). Pp. 12.

Webster Vacuum Heating System in the Boston City Hospital and Webster Modulation Steam Heating and Air Washing Systems in the Boston Safe Deposit and Trust Co. Building are the titles of similar pamphlets of 16 and 12 pp., respectively, giving the details of these two important installations. In the Boston City Hospital steam is supplied through mains over 1,000 ft. in length.

Still another publication is entitled "Modulation System of Steam Heating in the Sumner Apartments," showing the general method of application of this system to apartment house heating. Any or all of these pamphlets, we understand, will be sent upon application to the company at Camden, N. J.

FOR SALE

Best Automatic Air Valve Made

PATENTS BROAD AND BASIC

Valve is well known and a big seller. All necessary equipment included. Only small capital required. Exceptional opportunity.

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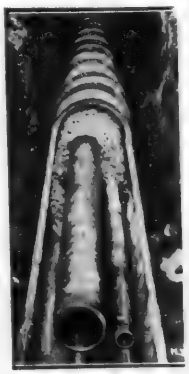
The Argon Mfg. Co.

DENVER

J-M Sectional Conduit



This is a tile conduit, salt-glazed inside and out. Is absolutely watertight.

Acids, gases or the action of the earth do not affect it. Neither can it be injured by weight or movement of pipes. Practically indestructible.

Easily opened after installation. Can even be taken up and relaid. The most efficient conduit for conveying steam, gas, water, brine or other liquids under ground.

Saves 90% of heat lost in transmission through unprotected or poorly insulated pipes.

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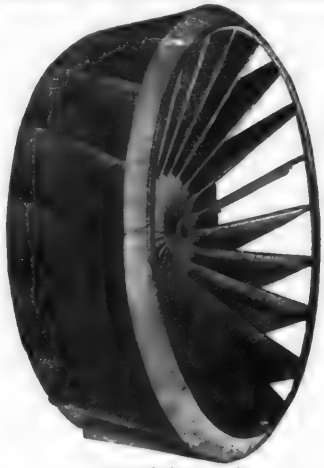
A CYCLOIDAL FAN or BLOWER
for all purposes. The Only Radical Improvement in Fans in Forty years
Takes up less room, runs at slower speed, requires less power, noiseless in operation

We guarantee our Cycloidals to equal in capacity any fan built—**We bar none**—with from 20 to 25 per cent. less speed and power. We build them in all sizes to suit all conditions—hundreds of them in use—not "as good—but better."



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Established 1879

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At Last a Packless Water Valve is the subject of a circular that is being sent out to the trade by the United States Radiator Corporation, Detroit, Mich. Exterior and interior views are shown of this valve which is known as the Triton Packless Water Valve. The company is prepared to furnish full descriptive circular and prices to those interested. Other circular matter issued by this company describes the Capital radiator shield which is built in three lengths, although, on special order, shields of any exact lengths will be made. A feature of the Capitol shield is a patent dust retainer attached to the shield, which can be lowered for the purpose of cleaning. This device is designed to catch all dust particles which circulate in the air currents arising from the radiator.

A third circular describes the Capitol improved sectional boilers which are made for both water and steam, the capacities ranging, for water, from 750 to 14,100 sq. ft. of radiation and, for steam, from 450 to 8,550 sq. ft. radiation. Fine points about the Capitol boilers are stated to be the countersunk header, long flue travel, extension heating surface, thin waterways, slip-nipple connection, divided sections, large flues, deep firepot, double shakers and convenient shaking apparatus.

New Firms and Business Changes

Cook & McDonnell, 320 Insurance Building, Oklahoma City, Okla., is the title of a new heating and ventilating engineering and contracting firm recently established in Oklahoma City.

New Incorporations

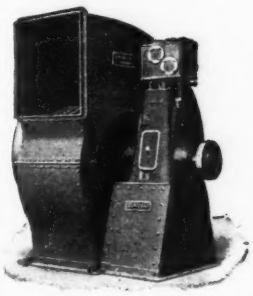
Toledo Mfg. & Supply Co., Toledo, O., capital $10,000, to manufacture steam fitting and plumbing supplies. Incorporators: Sigmund Sanger, Trude Wooster, K. A. Kaley, George P. Hahn, and F. W. Widmaier.

Mehring & Hanson Co., Chicago, notice of whose organization was published in last month's issue, has been incorporated with a capital of $40,000, to conduct a heating and ventilating business.

Mass & McAndrew Co., Rochester, Minn., capital $60,000, to conduct a heating and plumbing business. Among the incorporators is Ernest Mass.

Standard Vacuum Cleaner and Sweeper Co., San Francisco, Cal., capital $100,000. The incorporators include T. E. Pope, G. A. Pope, H. H. Sebree, J. W. Geary and A. B. Bennett.

Excelsior Co., New York, capital $500,000, to manufacture valves and plumbing supplies. Incorporators: I. B. Wood, L. Sternfeld, and W. D. Cushman.



The Sturtevant Multivane Fan

The most efficient commercial Fan in the world.

Occupies less space than any other type and can be built to run at the highest speed.

It is carefully designed and rigidly constructed.

Our Engineers will make recommendations to meet specifications or suggest the best method of installation.

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Charles M. Oberlin & Co., South Bend, Ind., capital $10,000, to conduct a heating and plumbing business. Incorporators: C. M. Oberlin, I. J. Miller and M. F. Ritter.

Rock Island Register Co., Rock Island, Ill., capital $30,000, to manufacture and deal in heating and ventilating apparatus. Incorporators: J. J. Burgess, S. P. Burgess and Jens Nielsen.

Laramie Heating Co., Laramie, Wyo., capital $75,000.

Vaporlite Co., New York, capital $500,000, to deal in heating and lighting appliances. Incorporators: W. P. Pritchard, E. P. Cooke, H. B. Baker, New York.

J. Looney Co., 85 City Hall Ave., San Francisco, Cal., capital $50,000, to conduct a heating and plumbing contracting business. Incorporators: R. H. Griffiths, J. Looney, W. T. Elliott, James Mearns and James Reilly.

Ideal Plumbing & Contracting Co., North Milwaukee, Wis., capital $16,000. Incorporators: Theodore Walch, Otto Seefeld and Ernst von Briesen.

New Contracts

Taylor & Co., Boston, Mass., heating Waterville High School in Waterville, Me., for $3,684. The plumbing contract went to Gideon Picher, Waterville, at his bid of $2,475.

W. A. Stuart Co., Livermore Falls, Me., steam heating high school building at Livermore Falls for $3,500.

M. J. Holmes Co., Worcester, Mass, heating Thomas Street School in Worcester for $4,431.

Nicholas J. Smith, Worcester, Mass., heating Elizabeth Street School in Worcester for $6,086.

Bartley, Kennedy & Co., Pittsburg, Pa., steam heating new school building at Beaver Falls for $4,700.

McGinness-Smith Co., Pittsburg, Pa., heating and ventilating new Mt. Washington sub-district school for $8,000; heating Christian Church at Newcastle for $3,000; also heating new Crutchfield-Woolfolk Building at Penn and Shady Avenues, Pittsburg, for $5,000.

Lewis & Kitchen, Kansas City, Mo., heating addition to the Ashland School in Kansas City for $3,935.

Laskey & McMurrer, Boston, heating and ventilating new Aquarium Building at City Point, Boston, for $15,887. Other bids were: L. W. Taylor Co., $17,283; J. J. Hurley, $20,540; Pierce & Cox, $22,195; Ingalls & Kendricken, $24,240; William H. Gallison Co., $24,590; Lynch & Woodward, $19,870; James P. Dwyer, $18,647; A. B. Franklin, $21,615.

SELF CONTAINED VENTILATING OUTFITS

BLOWER—WASHER—SPRAY PUMP

Compactly designed in seven sizes. Capacity of units 2,000—7,000 cu. ft. of air per minute

For Factories, Offices, Stores, Restaurants, Banks and Theatres

We ship the equipment assembled—you make the service connections

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Poor Heating Plants Made Perfect

Most times when a heating plant gives trouble, the real cause of the trouble is not found. More often the heating plant is large enough, but the condition of the windows is such that the leakage of air around same is so great that the heating plant cannot do the work intended.

We are prepared to investigate buildings of this kind to see whether the cause of trouble can be cured by Chamberlin Metal Weather Strip.

WRITE US FOR MORE DETAILS

CHAMBERLIN METAL WEATHER STRIP COMPANY

Branches in all cities **233-35 West Fort Street, DETROIT, MICH.**

Johnstown Supply House, Johnston, Pa., heating, ventilating and plumbing Cambria Theatre.

Meyer Merc. Co., Delta, Colo., heating new high school building at Paonia for $5,000.

Stapel Heating and Ventilating Co., Montgomery, Ala., heating new wing of the Capitol for $3,750.

C. A. Salisbury, Atlantic, Ia., heating and plumbing new Whitney Bank building at that place.

C. M. Masters, Mankato, Minn., central heating plant for the Mankato Normal School. The plant is to be finished by November 15, work having been begun in August, and will cost $7,923, outside of the building itself which will cost $12,238, the J. B. Nelsen Construction Co. having the building contract.

Salina Plumbing Co., Topeka, Kan., heating, plumbing and lighting for new Memorial Hall at Topeka, for $9,800.

Atlanta Steam Heating Co., Atlanta, Ga., heating Auditorium of that city for $4,839. A hot blast system will be installed. Other bids were: Englehart Heating Co., $5,579; Mongrief Furnace Co., $5,626.42.

A. J. Anderson & Co., Louisville, Ky., heating and ventilating Girls' High School building in Louisville for $29,566; also heating and ventilating addition and gymnasium of the George Rogers Clark School for $1,075.

Harstick Heating Co., Memphis, Tenn., steam heating manual arts building on the new Central High School grounds for $2,950.

J. J. Mulligan, Vicksburg, Miss., heating Speed Street School at Vicksburg for $1,475.

W. A. Patterson Co., Appleton, Wis., heating and ventilating system for High School building at Neenah, Wis., now used as the First Ward School. The plant will cost $3,700.

Cook & McDonnell, Oklahoma City, Okla., heating, ventilating and automatic temperature regulation for new high school building at Blackwell, Okla. The contract amounts to $4,700.

M. J. Daly & Sons, Waterbury, Conn., heating, plumbing and metal work in connection with alterations at the City Hall, for $5,699.

Pierce & Cox, Boston, Mass., heating and ventilating Quincy School, Boston, for $9,717. Other bidders were: J. J. Hurley & Co., $9,948; Commonwealth Heating Co., $10,497. James F. Dwyer, $10,800; Hern-Furlong Co., $10,088; C. H. Sanborn, $11,125; F. W. Zemier & Co., $10,996.

TEMPERATURE RECORDERS ARE THE KEYS TO THE HEATING SYSTEM

Each installation needs to be designed and regulated to fit the conditions involved

Standard Recording Thermometers

will give you the records to enable you to balance plant and maintain conditions of even temperature.

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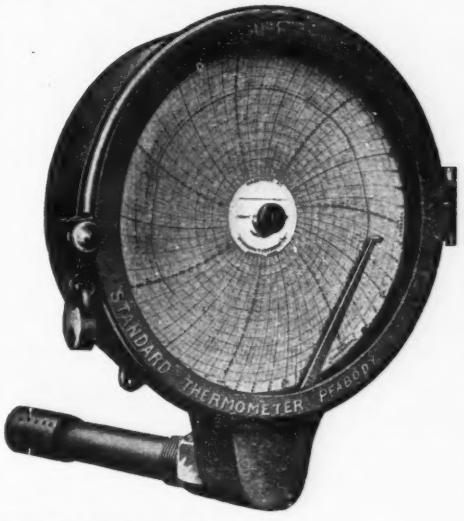

STANDARD THERMOMETER CO.
BOSTON, MASS.

Stone, Underhill & Co., Boston, heating and ventilating new county court house in Quincy, Mass., for $3,250.

P. J. Gallagher, Faribault, Minn., heating and plumbing new post-office building in that city.

Faucett & Faucett, Preston, Minn., heating new school building at that point.

Chamberlin Metal Weather Strip Co., Detroit, Mich., has just completed an important contract in weather stripping the palace of Count Szechenyi at Budapest, Hungarv. After investigating the merits of the Chamberlin equipment, the count, who married Miss Vanderbilt, of New York, had the Chamberlin system installed because of the fact that in the large rooms of the palace it would otherwise have been impossible to maintain even temperatures on account of the leakage of air around the windows. It was necessary on this contract to send workmen to Hungary from the company's New York office to do the installing.

Business Chances

Baltimore, Md.—C. Herbold & Sons have made application at the building inspector's office for a permit to begin work on 16 brick dwellings on North and Alingluff Avenues. Each house will be 14 x 59 ft. and will have steam heating plants. The total cost of the operation will be $28,000.

Peoria, Ill.—Hotchkiss & Harris, architects, are drawing plans for a central heating plant of the Tazewell County farm buildings. The heating plant will be of sufficient capacity to heat the present buildings as well as three new buildings for which the contract has recently been let.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until Sept. 15, 1911, for the mechanical equipment, excepting the elevators and mail handling apparatus, including plumbing, gas fitting, boiler plant, heating and ventilating system, conduit and wiring system, vacuum cleaning system, and induced draft system for the U. S. post office, Washington, D. C. Copies of the plans and specifications may be had in Washington or from D. H. Burnham & Co., Chicago, Ill., the architects of the building.

Tomah, Wis.—Robert M. Pringle, government adviser of the heating of buildings in the Indian service, will recommend an entirely new heating and ventilating plant for the buildings of the Indian School at Tomah.

THE VALVE THAT WORKS

89 Mowell Automatic Relief Valves are installed in the Doherty Silk Mill, in Paterson, one of the most up-to-date plants in the country and THE SYSTEM WORKS PERFECTLY

Send for descriptive matter, telling how the Mowell Automatic Relief Valve is suited to Exhaust and Low Pressure Steam Heating, how it expels all air and water from the radiator and how easy it is to keep clean.

Augustus Mowell
249 Graham Avenue, PATERSON, N. J.